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A REVISION OF RHODODENDRON SECTION LAPPONICUM

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ABSTRACT. A taxonomic revision of *Rhododendron* sect. *Lapponicum* (Balf. f.) Philipson & Philipson (raised to sectional status from that of series) includes a key to the twenty-six species recognized. Maps show the range of each species (except that of *R. lapponicum*). The species are all confined to the Sino-Himalayan region, particularly to the area where Tibet, China and Burma meet, except for *R. lapponicum* which is widespread in the colder parts of the northern hemisphere and *R. burjaticum* known only from near Lake Baikal. One new species is described (*R. minyaense* Philipson & Philipson) as are three subspecies and several varieties. Twenty five species are relegated to synonymy for the first time and three to varieties. *R. setosum* D. Don is excluded from sect. *Lapponicum* and the new section *Setosum* described to include it. Collectors' numbers and identifications are given in an appendix.

DEFINITION OF THE SECTION

It was nearly seventy years after Linneaus (1753) published *Azalea lapponica* that D. Don (1821) described *Rhododendron setosum* and in doing so compared his Nepalese species with *R. hirsutum* rather than with *R. lapponicum*. However, when Hooker (1849) described *R. nivale*, after another thirty years, he considered that this species and also Don's *R. setosum* showed affinity with the arctic *R. lapponicum* rather than with the species of the European Alps. Similarly, when Maximovicz (1877) described two species from northern China (namely, *R. capitatum* and *R. thymifolium*) he compared them with *R. parvifolium* and *R. nivale* respectively. Franchet did not always postulate relationships for his new species, but he did compare *R. nigro-punctatum* with *R. thymifolium*.

It is evident that at this early date, with very few species known, their inter-relationship was already recognized, and this continued with the several species published by Rehder and Wilson early this century. It is true and understandable that W. W. Smith (1914) did not associate *R. cuneatum* with these smaller leaved species, but he compared *R. rupicola* with *R. fastigiatum*. Two years later Bayley Balfour (1916), with W. W. Smith and Kingdon Ward, published ten species which, together with several described previously, he attributed to the *Lapponicum* Series. A description of this Series, with a discussion of its characters appeared later in the same volume (p. 298). Keys

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to the species in six subseries were provided and in *The Species of Rhododendron* (Stevenson, 1930) a key to all the species appeared. Sleumer (1949) gave the status of subsection to this Series.

The only other formal names proposed for the species related to *R. lapponicum* are *Rhododendron Series Parvifolia* E. Busch (1952) and *R. Series Burjatica* Malyshev (1961).

Although the concept of the Lapponicum group developed empirically, it appears to be homogeneous within limits to be discussed presently, and discrete from other lepidote Rhododendrons. Sleumer separates the Lapponicum group from *R. ferrugineum* and its allies by the crenate leaf-margin of the latter, and there are also differences of corolla shape. Section *Pogonanthum* may be separated by the fimbriate scales as well as by corolla shape. Other small-leaved alpine lepidote Rhododendrons may resemble Section *Lapponicum* closely, and formal diagnostic features may be difficult to define, partly because these groups have not all been closely studied. A character of the lower leaf epidermis has proved of value in assessing relationship. In several lepidote groups the epidermal cells that lie between the insertion of the scales are each prolonged outwards as a hollow papillum frequently ornamented by ridges (Plates 1, 2A-E). In other groups these papillae do not occur. Epidermal papillae have been found in all species included within Section *Lapponicum* with the single exception of *R. setosum*, whose position in relation to the other members of the Section will be discussed below.

As far as our investigations have gone epidermal processes are absent from the following subsections: *Triflora*, *Micrantha*, *Saluenensia* and *Ferruginea*, which therefore stand apart from the *Lapponicum* group. However, epidermal processes occur in several groups which resemble Section *Lapponicum* rather closely in other respects. In Section *Pogonanthum* the processes are typically longer, finer and less ornamented, but in any case, the characters of the scales and corolla serve to distinguish this section. On the other hand, species of the *Uniflora* Subsection can appear very similar to certain species of Sect. *Lapponicum*, though their flowers are usually larger and pubescent on the outside (characters approached by *R. dasypetalum*). A character which serves to separate these two groups is the attitude of their flowers. These are held in line with relatively short pedicels in Sect. *Lapponicum*, but are nodding on longer pedicels in Subsect. *Uniflora*. The same considerations apply to Subsects. *Lepidota*, *Baileya* and *Campylogyna*, which in addition have bent styles, whereas the styles in Sect. *Lapponicum* are straight. The leaves of most species of Subsect. *Glaucophylla* are very glaucous below, and in addition the styles in this Section are mostly short and curved.

Two species show some characters of both the *Triflorum* and *Lapponicum* groups. *R. wongii* Hemsley & Wilson, is typical of Subsection *Triflora* in all characters except that of leaf size. *R. gemmiferum* Philipson & Philipson (1974) is more truly intermediate and has not been attributed to any recognized group. It resembles Sect. *Lapponicum* in the following respects: the small leaves with a dense covering of scales below and with epidermal papillae; the ovary aligned with the pedicel, and the style straight. However, its buds resemble those of the *Triflorum* group, being large, typically separated by distinct internodes, and with cataphylls more distinctly imbricated than is usual in Section *Lapponicum*.

The unique bristles present on the shoots and leaves of *R. setosum* set it apart from the other species of Sect. *Lapponicum*. Its distinctness is confirmed by the lack of processes on the epidermal cells of the underside of the leaf and by the quite entire margin of the scales (Plate 2F). Some other species, e.g. *R. fastigiatum*, *R. flavidum* and *R. nivale*, may have scale margins that approach the entire condition but in them some undulations of the outer walls of the radiating cells always occur. In view of these distinctive characters *R. setosum* is excluded from this revision, and a Section is proposed for its inclusion.

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Sect. *Setosum* Philipson & Philipson, sect. nov.

Frutex humilis caulibus et inferioribus foliorum paginis setas longas ferentibus. In inferioribus foliorum paginis squamae marginibus integris late dispersae; papillae desunt. Inflorescentia umbella pauciflora terminalis. Corolla late infundibuliformis. Stamina \pm 10. Ovarium lepidotum.

Typus sect.: *Rhododendron setosum* D. Don (Mem. Wern. Soc. 3:409, 1821).

The new section is included in Subgenus *Rhododendron* to which several other small-leaved lepidote Asiatic sections belong. Of these the only other section in which similar bristles occur is *Saluenensia*, but in that section the posture and shape of the flower are different, the scales of the leaf are dense and bristles do not occur on the lower surface of the leaf.

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Some modification of Sleumer's treatment of the lepidote *Rhododendrons* appears desirable. He divided his subgenus *Rhododendron* into three Sections, namely *Lephipherum*, *Pogonanthum* and *Vireya*. While the latter large group appears morphologically and geographically distinct, the separation of *Pogonanthum* from the rest of the lepidote groups is more open to question. *Pogonanthum* is readily recognizable, but it appears to be less distinct from the geographically and ecologically similar *Lapponicum* group than are several other groups of lepidote species.

We would propose that *Pogonanthum* be given the same rank as the other subdivisions of *Lephipherum*, but that these should all be raised to the rank of Sections of the subgenus *Rhododendron*. A consequence of this change of rank is the recognition of *Vireya* as an additional subgenus: its size and distinctness amply justify this.

For these reasons, in the systematic part of this revision, the group is treated as a Section of the subgenus *Rhododendron*.

THE DELIMITATION OF SPECIES

About sixty binomials have been proposed which are attributable to Section *Lapponicum*, the majority of which occur in western Szechuan and northern Yunnan. Most of these names date from a period early in this century, when E. H. Wilson and George Forrest were collecting vigorously in China with the encouragement of Alfred Rehder at the Arnold Arboretum and of Bayley Balfour at Edinburgh. These collectors, and later Kingdon

Ward and Joseph Rock were searching for individuals or populations which displayed new features, and it is evident that, at that time, very slight differences were acceptable as a basis for specific distinction.

It is not surprising that this approach led to the description of several species which later collecting has shown to be minor variations within the range of variation of widespread species, nor that it became impossible to match many of the abundant new field collections with the existing narrowly defined species. Consequently the *Lapponicum* group acquired a reputation for difficulty and variability which was due at least as much to the botanical confusion as to any difficulty inherent in the material.

The difficulties found in the natural populations were aggravated by those encountered in cultivated material. Not infrequently the plants grown under a collector's number failed to correspond with the wild-collected herbarium specimens upon which the names of the seed had been based. Such non-correspondence may be due to several factors. For example, the seed may have been collected from a different species, the labels of the herbarium specimen or of the seed, or of the plants raised from it, may have been transferred at any stage from the field to the garden, or the wild seed may have been the result of hybrid pollination. Hybrids are more frequent in cultivation than in the wild, not only because of cross-pollination after introduction but also because wild-collected seed may be hybrid, a subject to be discussed below. Consequently very little reliance can be placed on cultivated specimens so that the present revision is based entirely on herbarium material collected in the wild. It was undertaken at the suggestion of Dr H. R. Fletcher, at that time Regius Keeper of the Royal Botanic Garden, Edinburgh, in the hope that the confused state of this group of *Rhododendrons* could be clarified.

Our approach has been to seek characters, and combinations of characters, which divide the mass of collected material into entities which can be defined morphologically and whose distribution is coherent. The very considerable variation encountered in several characters will be discussed below, but it was found that the very great majority of the (approx.) 1500 specimens studied could be assigned to twenty-six species (*R. lapponicum* has been omitted from this figure, because we saw a disproportionate number of specimens of that species, which, being isolated geographically from the rest of the Section, does not hybridize). Of the twenty-six species, the great majority (that is nineteen) occupy ranges of some considerable extent and have been collected repeatedly. Three others (*R. websterianum*, *R. nitidulum* and *R. minyaense*) have been collected less frequently and their ranges, as far as is known, are more restricted. A few other specimens are so distinctive morphologically that they must be maintained as species even though they are represented by only one or very few collections: these are *R. tsaii*, *R. burjaticum*, *R. amundsenianum* and *R. dasypetalum*.

There remain a relatively small number of specimens which cannot be assigned to any of the twenty-six species, but which combine characters of two that occur in the same area. These specimens, which amount to less than 4% of the total Sino-Himalayan specimens are regarded as hybrids. (In addition there are a very few specimens (usually imperfect) where the second parent of a putative hybrid could not be determined). More than half of these putative hybrids occur in an area where a hybrid swarm appears to have

developed between *R. russatum* and *R. rupicola*. The general level of hybridity among collected specimens is therefore about 2%. It is probable that this is in excess of the percentage in natural populations, since discerning collectors were searching for variants. With such similar species often growing in close proximity a higher incidence of hybridity would not have been surprising. It appears that cross-pollination may occur relatively frequently in the wild, producing hybrid seed. The failure of hybrids to become frequent in natural populations would then be due to natural selection operating against hybrid individuals. The evidence for this view is the fact that plants raised from wild seed not infrequently include hybrid individuals. These may even possess combinations of characters which have not been known to occur in the wild state. A number of species have been based on plants raised from wild-collected seed. Some of these show no significant variation from wild specimens of another species (and are therefore reduced to synonymy), but others have never been completely matched by wild-grown specimens. Examples are: *R. lysolepis*, *R. microleucum*, and a large form of *R. flavidum* with white flowers. These may not all be the results of inter-specific crosses, but they do indicate that wild seed includes types unlikely to survive in nature.

To sum up, relatively very few specimens fail to conform with the species defined in this revision, and virtually all of these specimens can be interpreted with confidence as hybrids between accepted species.

Our treatment of species has been broad, since recognition of taxa based on fine local distributions cannot be reliably attempted while field-work remains impossible. The species here recognized should form a framework for detailed local studies when these can be undertaken.

The species are often variable in respect to several characters, but nevertheless the character-combinations that define them provide a basis for recognition. Once these are understood the rather close resemblances between the often sympatric species can be seen to be superficial. In only one instance is the amount of variation displayed by a species greater than could be wished: this is so in *R. telmateium*. Attempts to reduce this complex to subspecies or varieties failed because all the characters available appear to combine in an uncorrelated manner and without geographical limits.

A discussion of several variable characters follows.

SOME VARIABLE CHARACTERS

Scales of the leaf. Bayley Balfour (1916) used characteristics of the scales on the lower surface of the leaf to divide the species of Section *Lapponicum* into six subseries. We confirm that this is the most useful feature for this purpose. Unfortunately, as will be discussed below, the scale characters are too variable to be used as absolute diagnostic characters either for species or for groups of species. Nevertheless, used in combination with other characters, they afford a satisfactory basis for species recognition and also for the grouping of species into useful associations.

Some of the variability in scale characters is due to the age of the leaf or the presence of epiphyllous fungi which are prevalent in wild-collected specimens, often causing infected scales to appear darker. In order to achieve as standard comparisons as possible, descriptions are based on mature healthy leaves, that is to say, leaves on the lower parts of current shoots or,

if the specimen were collected early in the season, then leaves on the previous year's growth. Only in the case of *R. fastigiatum* is the specific character of the scales seen most clearly in leaves not yet fully mature. It should also be borne in mind that this study is based on herbarium material, and that the scales are described and compared as they are seen in dried specimens. Our experience with authentic material in botanic gardens suggests that the colours of living leaves are paler than those described here, but that the comparisons between species remain valid.

There are many separate characters involved in the appearance of the scale-covering. The most important of these are:

- i. the colour of the scales, which may range from translucent and colourless to almost black;
- ii. differences in colour between the peripheral and central portions of the scales;
- iii. whether all the scales on one leaf are uniformly coloured or of two colours.
- iv. whether the darker scales (if present) are irregularly spaced and rather few (= punctulate), or more uniformly distributed and more numerous (= bicolorous).
- v. the density of the scales (overlapping, contiguous, contiguous in groups, discontinuous, widely spaced).

The individual scales also differ in the relative breadth of the periphery and the centre and in the degree of crenation of the margin, but these features are not employed in these comparisons.

It is convenient to recognize the following scale-types, and under each we have listed the appropriate species.

1. Uniformly coloured, pale and dense

<i>cuneatum</i>	<i>thymifolium</i>
<i>hippophaeoides</i>	<i>tsaii</i>
<i>intricatum</i>	<i>websterianum</i>
<i>nitidulum</i>	

2. Uniformly coloured, darker, dense

<i>amundsenianum</i>	<i>tapetiforme</i>
<i>complexum</i>	<i>yungningense</i>
<i>dasypetalum</i>	

3. Uniformly coloured, widely spaced

<i>fastigiatum</i>	<i>impeditum</i>
<i>flavidum</i>	<i>polycladum</i>

4. Punctulate

<i>bulu</i>	<i>orthocladum</i>
<i>minyaense</i>	<i>telmateium</i>

5. Bicolorous

<i>burjaticum</i>	<i>nivale</i>
<i>capitatum</i>	<i>rupicola</i>
<i>lapponicum</i>	<i>russatum</i>

These groupings are based on the most frequent appearance of the lower leaf surface in each species. The majority of the species always conform to these groupings. However, as has been stated, variation may be considerable, so that some individuals of a few species do not conform to the group to which that species is assigned, and these aberrations are set out below.

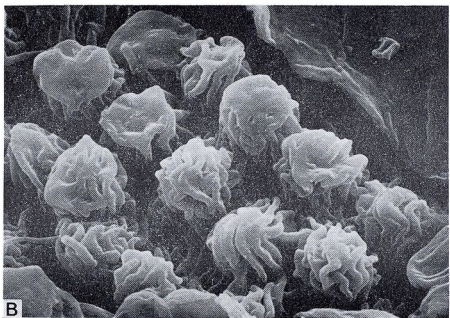
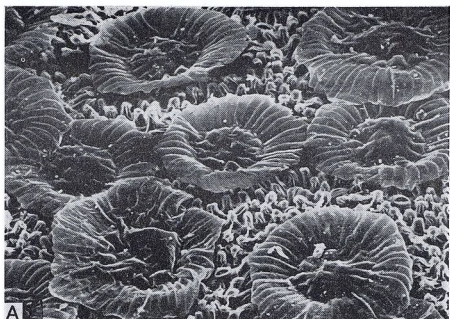


PLATE 1. Scanning electron micrographs of lower leaf surfaces: A, *R. cuneatum* (Forrest 10423), general view with scales, epidermal papillae and stomata $\times 130$; B, *R. lapponicum* (Norman s.n.) $\times 1600$.

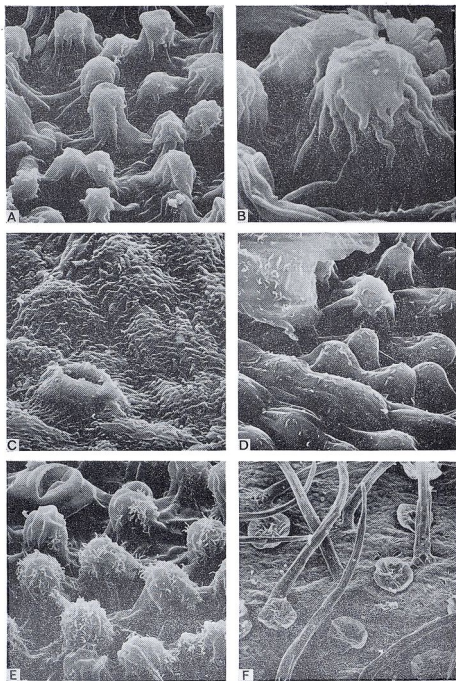


PLATE 2. Scanning electron micrographs of lower leaf surfaces: A, *R. capitatum* (Ching 871) $\times 1000$; B, *R. telmateium* (Forrest 21239) $\times 2900$; C, *R. flavidum* (Wilson 1202), area of leaf with low papillae and stomata $\times 1000$; D, *R. dasypetalum* (Forrest 13905) with papillae of varying prominence $\times 1000$; E, *R. fastigiatum* (Rock 8285), papillae with secondary ornamentation $\times 1000$; F, *R. setosum* (Maser 180), with bristles and entire scales but no papillae $\times 50$, (small cracks on surface due to imperfections in carbon-coating).

Of Group 1 the following species do not depart from the character of the group: *R. intricatum*, *R. tsaii*, *R. hippophaeoides* and *R. websterianum* (though varieties of the last two species are somewhat darker). In *R. cuneatum* the scales, though uniform, may range from pale to deep rusty red, when they would conform to Group 2. In *R. thymifolium* a few darker scales may occasionally be present (cf. Group 4). *R. nitidulum* var. *nitidulum* conforms to Group 1, but the var. *omeiense* usually has darker scales mixed with the paler background scales (cf. Group 4).

Of Group 2 the following species do not depart from the character of the Group: *R. complexum*, *R. dasypetalum*, *R. amundsenianum* and *R. tapetiforme*. In *R. yungningense* some darker scales may be present.

None of the four species included in Group 3 departs from the character of the Group, except that the scales of the single known specimen of *R. flavidum* var. *psilostylum* are not uniform in colour.

In all the species included in Group 4, the punctulations may occasionally be absent (cf. Groups 1 and 2) or more numerous.

Of Group 5 the following species do not depart from the character of the Group: *R. capitatum*, *R. lapponicum*, *R. burjaticum* and *R. rupicola*. In the two subspecies of *R. nivale* the contrast between the scale colours may occasionally be less marked, and in *R. russatum* a similar lack of contrast may result in a uniformly rusty brown surface.

Calyx lobes. After the scale-types, the characters which have been found most useful in the definition and recognition of species are those of the calyx lobes, particularly the length of the lobes, the distribution of scales on the outer surface, and the occurrence of scales and/or cilia on their margins.

A typical example of each species is illustrated (figs. 1, 2). The range of variability will be found in the descriptions of each species in the revision. It should be noted that in both *R. nivale* and *R. rupicola* variations in calyx characters have a geographical basis. A few species which are particularly variable are: *R. capitatum* and *R. nitidulum* var. *nitidulum* possess a calyx with lobes of unequal lengths, and the lobes may be irregular in shape. The calyx length in *R. yungningense* ranges from 0.5–6.0 mm and the density of scales on the outer surface is also variable.

Leaf size and shape. Typical examples of leaves of each species are illustrated in figure 3. The characters of the foliage give each species an appearance which may be distinctive but in general the ranges of size and shape of several species overlap. For this reason these characters are of limited value for recognition. In a few species the mid-rib is scarcely raised below, whereas in others the lateral veins can be discerned, though indistinctly. The presence or absence of a mucro and its prominence is of value in some cases, (e.g. *R. nivale* is almost invariably emucronate, whereas in *R. telmateium* the mucro is present and usually prominent).

Epidermal papillae. The epidermal cells of the lower surface of the leaf project as papillae and these give a matt appearance to areas exposed between the scales (Plate 1A). These papillae are rather similar throughout the Section. In general, each consists of a finger-like process whose sides are ornamented with raised ridges (Plate 1B; 2A, B). These may extend over the apex, or the

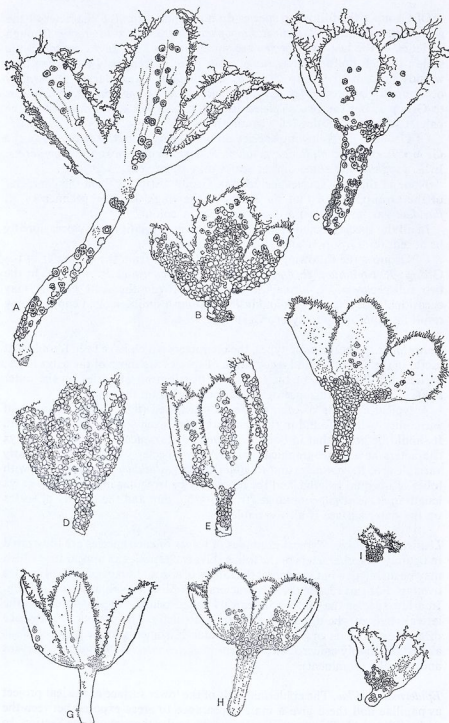


FIG. 1. Examples of the calyx of: A, *R. cuneatum* (Rock 25150); B, *R. minyaense* (Rock 17731); C, *R. russatum* (Rock 9194); D, *R. rupicola* var. *niliense* (Rock 17967); E, *R. rupicola* var. *rupicola* (Rock 9663); F, *R. websterianum* var. *websterianum* (Wilson 3462); G, *R. flavidum* var. *flavidum* (Stevens 350); H-J, *R. capitatum* (H, Farrer 119; I, Rock 12647; J, Ching 524). All $\times 6$.

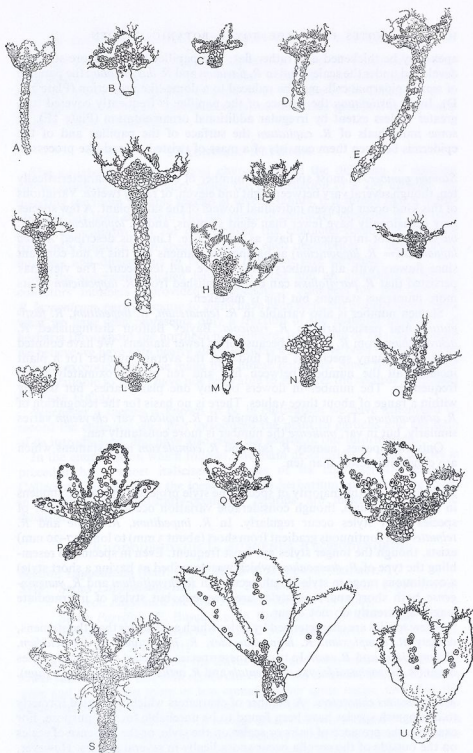


FIG. 2. Examples of the calyx of: A, *R. tsaii* (Tsai 50928); B, *R. yungningense* (Ching 20496); C, *R. telmateium* (Rock 5597); D, *R. burjaticum* (Malyshev 4600); E, *R. lapponicum* (Nannfeldt & Pilat s.n.); F, *R. hippophaeoides* var. *hippophaeoides* (Rock 24729); G, *R. hippophaeoides* var. *occidentale* (Forrest 23341); H, *R. nitidulum* var. *nitidulum* (Wilson 3935); I, *R. thymifolium* (Rock 6473); J, *R. complexum* (Rock 8456); K, *R. polycladum* (Forrest 10015); L, *R. orthocladum* var. *longistylum* (Rock 17135); M, *R. intricatum* (Rock 17961); N, *R. tapetiforme* (Rock 22872); O, *R. bulu* (Ludlow, Sherriff & Elliot 12397); P–R, *R. nivale* (P, var. *nivale*, Ludlow & Sherriff 13125; Q, var. *boreale*, Rock 22848; R, var. *australe*, Rock 9519); S, *R. dasypetalum* (Forrest 13905); T, *R. fastigiatum* (Rock 9496); U, *R. impeditum* (Rock 23720). All $\times 6$.

apex may be thickened and rather flat. The papillae may be more strongly developed under the scales, and in *R. flavidum* and *R. dasypetalum* the papillae of some epidermal cells may be reduced to a dome-like projection (Plate 2C, D). In *R. fastigiatum* the surface of the papillae is frequently covered to a greater or less extent by irregular additional ornamentation (Plate 2E). In some individuals of *R. capitatum* the surface of the papillae and of the epidermis between them consists of a mass of twisted, thread-like processes.

Stamen number. In most species the number of stamens is characteristically ten, though several vary between eight and eleven, or rarely twelve. Variations of this kind occur between individual flowers of the same plant. A few species may occasionally have fewer than eight stamens, and *R. lapponicum* and *R. burjaticum* not infrequently have as few as five. Linnaeus described *Azalea lapponica* (= *R. lapponicum*) as having five stamens but this is not constant since flowers with all numbers between five and ten occur. The view has persisted that *R. parvifolium* can be distinguished from *R. lapponicum* by its more numerous stamens but this is mistaken.

Stamen number is also variable in *R. telmateium*, *R. impeditum*, *R. fastigiatum* and particularly in *R. rupicola*. Bayley Balfour distinguished *R. achroanthum* from *R. rupicola* because of its fewer stamens. We have counted stamens of many specimens and find that the average number for a plant includes all the numbers between five and ten at approximately equal frequencies. The number in flowers on any one plant varies, but usually within a range of about three values. There is no basis for the recognition of *R. achroanthum*. The number of stamens in *R. rupicola* var. *chryseum* varies similarly, but in var. *muliense* the number is more constantly ten.

Only two species, namely *R. tsaii* and *R. complexum* have stamens which are constantly fewer than ten.

Style length. In the majority of species the style projects beyond the stamens in most individuals, though considerable variation occurs. In a number of species short styles occur regularly. In *R. impeditum*, *R. nivale* and *R. telmateium* a continuous gradient from short (about 3 mm) to long (17–20 mm) exists, though the longer styles are most frequent. Even in specimens resembling the type of *R. drumonium* (which was described as having a short style) a continuous range in style-length occurs. In *R. thymifolium* and *R. yungningense* both short and long styles are frequent, but styles of intermediate length apparently do not occur.

A few species are characterized by styles which are shorter than the stamens, namely *R. complexum*, *R. hippophaeoides*, *R. intricatum*, *R. orthocladum*, *R. burjaticum* and *R. tsaii*. In two of these species varieties with longer styles occur (*R. hippophaeoides* var. *occidentale* and *R. orthocladum* var. *longistylum*).

Miscellaneous characters. A number of characters which were used formerly to distinguish species have been found to be unreliable for this purpose. For example, the presence of hairs or scales on the style, or the presence of scales on the outside of the corolla occur sporadically in several species. However, these features are characteristic of some species, e.g. a pubescent style in *R. russatum*, *R. flavidum*, *R. cuneatum* and *R. bulu*, and scales are more or less constant on the outside of the corolla lobes of *R. rupicola* and *R. telmateium*.

Similarly the flower form may be distinctive, as in *R. intricatum* and *R. complexum* where it is narrowly tubular with the style and stamens not exerted. The curious absence of hairs from the base of the filaments of *R. tsaii* may prove to be an individual variation since this species is known only from a single collection.

TAXONOMIC REVISION

The variability found in most characters and the difficulty of defining colour combinations verbally, made the construction of a key difficult. By inserting the more variable species at several points, it is hoped that a workable key has been achieved. The full range of character variation is recorded in the descriptions but for convenience the character-combinations most frequently found in each species precedes each description. In descriptions, numbers and dimensions in brackets represent rare extremes.

All the specimens studied have been cited and an alphabetical list of collectors' numbers is provided in appendix 2. Numbers are not cited for *R. lapponicum*, partly because so many have been seen, but principally because what we have seen represents only a fraction of the material preserved in herbaria throughout the northern hemisphere. In the case of all other species we believe we have seen nearly all collections which have been made, with the notable exception of those made by Chinese botanists. Since these have not been available to us we have not been able to interpret the records published by Fang (1939).

Whenever a species is known to be in cultivation we have attempted to record the collector who first introduced the plant to gardens and the date of its introduction, and have also cited the source of our information.

In the enumeration which follows, the main description of each species is preceded by a short italicised synopsis of its characteristic features. Collectors' numbers and the location of the herbarium specimens are given in smaller print; naturally-occurring hybrids are mentioned after the discussions.

RHODODENDRON L. SUBGENUS RHODODENDRON

Section **Lapponicum** (Balf. f.) Philipson & Philipson, *stat. nov.*

Syn.: Series *Lapponicum* Balf. f. in Notes R.B.G. Edinb. 9:298 (1916).

Subsect. *Lapponica* Sleumer in Bot. Jahrb. 7:535 (1949).

Series *Parvifolia* E. Busch p.p. in Komarov, Fl. URSS 18:44 (1952).

Series *Burjatika* Malyshev in Not. Syst. Herb. Inst. Bot. Akad. Sci.

URSS 21:455 (1961).

Small to moderate shrubs, the leaves small and with entire margins. The lower surface of the leaf with scales closely packed to apart, their peripheries wide and the margin more or less crenate, never quite entire, and with the epidermal cells papillate, the papillae ornamented with ridges. The inflorescence a terminal umbel of one to several small flowers; pedicels short and in line with the axis of the flower. Corolla usually broadly funnel-shaped, more rarely shortly salver-shaped. Stamens mostly 5-10. Ovary lepidote.

24 spp. in alpine regions of West China, Tibet and the Himalayas, 1 sp. (*R. lapponicum*) widespread in arctic and sub-arctic regions, and 1 sp. (*R. burjatikum*) near Lake Baikal.

KEY TO THE SPECIES

1. Scales on the lower surface of the leaf opaque, white or pinkish 13. *fastigiatum*
- + Scales not as above 2
2. Corolla 20 mm or longer 1. *cuneatum*
- + Corolla less than 20 mm long 3
3. Scales on the lower surface of the leaf uniformly coloured 4
- + Scales on the lower surface of the leaf of two colours (or tints) 22
4. Flowers yellow or white 5
- + Flowers not yellow or white 7
5. Scales on the lower surface of the leaf widely spaced 14. *flavidum* var. *flavidum*
- + Scales on the lower surface of the leaf more densely arranged 6
6. Calyx 1.5 mm long or shorter 17. *orthocladum* var. *microleucum*
- + Calyx 2.8 mm or longer 6. *websteranum* var. *yulongense*
7. Scales on the lower surface of the leaf, pale (straw-coloured to fawn) 8
- + Scales on the lower surface of the leaf rufous or brown 13
8. Stamens 4-7, filaments glabrous 2. *tsaii*
- + Stamens more than 7, filaments pilose near the base 9
9. Stamens and style not exerted 3. *intricatum*
- + Stamens and style longer than the corolla tube 10
10. Inflorescence more than 2-flowered 4. *hippophaeoides*
- + Inflorescence 1- or 2-flowered 11
11. Calyx 1.0 mm long or shorter 5. *thymifolium*
- + Calyx 2.0 mm or longer 12
12. Central area of scales on lower surface pale; leaves usually narrowly elliptic, base widening gradually from petiole 6. *websteranum* var. *websteranum*
- + Central area of scales on lower surface golden; leaves usually elliptic, base widening abruptly from petiole 7. *nitidulum* var. *nitidulum*
13. Style shorter than, or equal to, the stamens 14
- + Style longer than the stamens 16
14. Stamens 5-6 8. *complexum*
- + Stamens about 10 15
15. Leaves lanceolate or narrowly elliptic 17. *orthocladum* var. *orthocladum*
- + Leaves elliptic to broadly elliptic 9. *yungningense*
16. Mature leaf with brown scales dispersed over the pale lower surface 17
- + Mature leaf with scales more closely arranged 18
17. Calyx lobes longer than 2.5 mm 15. *impeditum*
- + Calyx lobes shorter than 2.5 mm 16. *polycladum*
18. Calyx lobes shorter than 2.0 mm 19
- + Calyx lobes longer than 2.0 mm 20
19. Leaves broadly elliptic or rotund, lower surface of leaf rufous 10. *tapetiforme*
- + Leaves lanceolate or narrowly elliptic, undersurface of leaf brown 17. *orthocladum* var. *longistylum*

20. Outside of corolla pilose 11. *dasypetalum*
 + Outside of corolla epilose (occasionally minutely puberulous) . . . 21
 21. Lower surface of leaf dark brown 12. *amundsenianum*
 + Lower surface of leaf paler (ferruginous or tan) . . . 9. *yungningense*
 22. The darker scales few and scattered 23
 + The darker scales more evenly dispersed 28
 23. Calyx lobes longer than 4.0 mm 18. *minydense*
 + Calyx lobes shorter than 4.0 mm 24
 24. The background scales of the lower surface of the leaf buff . . . 25
 + The background scales of the lower surface of the leaf brown . . . 17. *orthocladum*
 25. Leaf usually longer than 12 mm (valley of the Tsangpo, Tibet) . . . 19. *bulu*
 + Leaf usually shorter than 12 mm (Yunnan and Szechuan) . . . 26
 26. Corolla lepidote outside; leaf strongly mucronate . . . 20. *telmateium*
 + Corolla elepidote outside; leaf slightly mucronate . . . 27
 27. Flower rosy or purple 7. *nitidulum* var. *omeiense*
 + Flower yellow 14. *flavidum* var. *psilostylum*
 28. Leaf emucronate, with decided contrast between dark and pale scales, small (usually less than 9.0 mm long) . . . 21. *nivale*
 + Leaf not with the above combination of characters . . . 29
 29. Calyx 2.5 mm long or shorter 30
 + Calyx longer than 2.5 mm 32
 30. Leaf lanceolate or narrowly elliptic 17. *orthocladum*
 + Leaf elliptic 31
 31. Style shorter than the stamens 22. *burjaticum*
 + Style longer than the stamens 23. *lapponicum*
 32. Leaf emucronate 24. *capitatum*
 + Leaf mucronate 33
 33. Calyx lobes without a central band of scales . . . 25. *russatum*
 + Calyx lobes with a central band of scales . . . 26. *rupicola*

1. *R. cuneatum* W. W. Smith in Notes R.B.G. Edinb. 8:200 (1914).

Syn.: *R. ravum* Balf. f. & W. W. Smith, l.c. 9:270 (1916).

R. cinereum Balf. f. in Millais, J. G., *Rhododendrons*, p. 145 (1917).

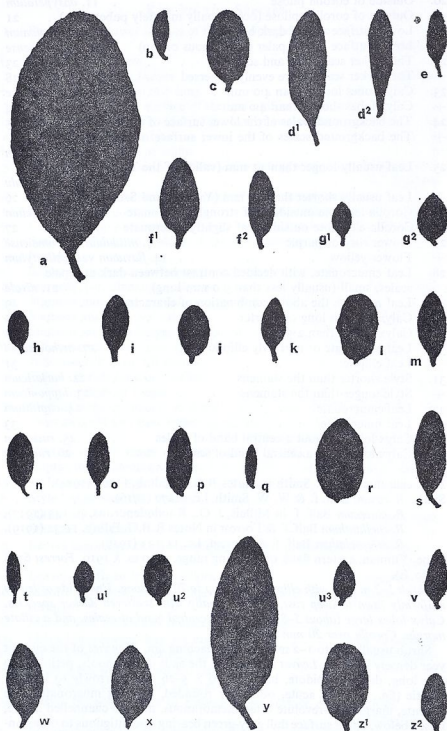
R. cheilanthum Balf. f. & Forrest in Notes R.B.G. Edinb. 11:32 (1919).

R. sclerocladum Balf. f. & Forrest, l.c. 11:133 (1919).

Type. Yunnan, eastern flank of Lichiang range, 3650 m, x 1910, *Forrest* 6738 (holo. E).

Shrub 1-2 m high with elliptic leaves, up to 70 mm long. Underside of leaves uniformly fawn to deep rust, or occasionally with scattered darker speckles. Calyx lobes large (about 5-8 mm) with a central band of scales, and a ciliate margin. Corolla over 20 mm long.

Shrub usually up to 1-2 m high, but reaching 4m. Branches of the current year densely lepidote. Leaves clustered at the ends of the shoots, petiole 1-10 mm long, densely lepidote, blade 11-70 x 5-26 mm, narrowly to broadly elliptic (fig. 3a) apex acute, obtuse or rounded, strongly mucronate, base cuneate, margin sub-revolute often membranous, mid-rib channelled above, raised below, upper surface dull grey-green bearing discontinuous to occasionally contiguous pale scales, under surface uniformly fawn to deep rust or



occasionally with scattered darker speckles, the scales contiguous and often overlapping but sometimes with some pale leaf surface visible, varying in colour from translucent buff to copper or deep red-brown, the centre often darker than the periphery. *Inflorescence* up to 6-flowered, pedicels 2–13 mm long, pale lepidote. *Calyx* (2–)5–8(–12) mm long, lobes usually oblong with a rounded or pointed apex, membranous usually reddish, with pale scales forming a central band, margin long ciliate and sometimes with a few scales, (fig. 1A). *Corolla* deep-purple to rose-lavender, often with darker markings, rarely almost white, funnel-shaped, pubescent in the throat, and often also on the outside of the corolla, lepidote, often sparingly, or elepidote, tube (5–)10–16(–20) mm long, lobes (7–)12–15 mm long. *Stamens* 10(9), pubescent at the lower part, varying in length, shortest 12–25 mm, longest 16–32 mm long. *Ovary* about 3–4 mm long covered with pale scales except for a narrow basal pubescent band, style (13–)15–34 mm long, longer than or rarely equal to the stamens, pubescent. *Stigma* discoid. *Capsule* ovoid, up to 14 mm long, lepidote; calyx persistent.

YUNNAN, SZECHUAN: on the Mekong-Yangtze divide from about 26°30'–27°20' north, and extending north-eastwards past Chungtien and the Likiang Range, to the vicinity of Yungning and Muli. One typical specimen was collected by Schneider further east at Liuku (approx. 28°30' N; 102°20' E) (fig. 5).

Ching 20322 (A); 20325 (A); 20327 (A); 30031 (A); 30156 (A); 30198 (A); Feng 317 (A); 651 (A); 1270 (A); Forrest 10059 (A, K); 10071 (A, BM, E, K); 10157 (A); 10423 (type of *R. ravum*—E, K); 10435 (type of *R. cheilanthum*—E, K); 11736 (E, K); 12417 (BM, E); 12665 (type of *R. sclerocladum*—E, K); 13761 (E); 15218 (BM, E); 15225 (E); 15427 (E); 15448 (E); 15464 (E); 16129 (E); 21030 (E); 21059 (E); 21369 (E); 21375 (BM, E); 21456 (E); 21948 (BM, E); 22197 (E); 22203 (BM, E); 22548 (BM, E); 23348 (E); 23352 (E); 23353 (E); 23355 (E); *Goodspeed* 32/1835 (E); *McLaren* P23 (BM, E); P70 (BM, E, K); P73 (BM); *Rock* 3473 (A, US); 3483 (E, US); 3483a (A, US); 3563 (US); 4081 (A, E, US); 4170 (A, US); 5392 (US); 5514 (US); 8191 (A, US); 8317 (A, K, US); 8319 (A, E, K, US); 8331 (A); 8362 (A, US); 8441 (E, US); 8509 (A, US); 11271 (US); 11287 (E, US); 11368 (US); 11392 (US); 11393 (E); 16963 (US); 17025 (US); 17108 (US); 17191 (E); 17194 (A, E, US); 17197 (E, NY); 25150 (A, BM, K, NY); *Schneider* 1303 (A); *Ward* 4341 (A, E); 5030, s.p. (E); 5037 (E); 5049 (E); 5103 (E); *Yü* 5098 (A); 5327 (A); 15027 (A, BM, E); 15092 (A).

First collected in 1910 by George Forrest in the Likiang Range. It was introduced to cultivation from seed collected by Forrest in 1913 (as *R. cheilanthum*). The statement in the *Dictionary of Gardening* (ed. Chittenden, 1951) that this species was introduced in 1906 must be an error. Variation in

FIG. 3. Leaf silhouettes of: a, *R. cuneatum* (Rock 8362); b, *R. tsaii* (Tsai 50928); c, *R. intricatum* (Wilson 3934); d¹, *R. hippophaeoides* var. *hippophaeoides* (Rock 8464); d², *R. hippophaeoides* var. *occidentale* (Forrest 23005); e, *R. thymifolium* (Yü 6066); f¹, *R. websterianum* var. *websterianum* (Wilson 3462); f², *R. websterianum* var. *yulungense* (Rock 17492); g¹, *R. nitidulum* var. *nitidulum* (Wilson 3461); g², *R. nitidulum* var. *omeiense* (Chiao & Fan 703); h, *R. complexum* (Forrest 12520); i, *R. yungningense* (Forrest 21290); j, *R. tapetiforme* (Rock 22872); k, *R. dasypetalum* (Forrest 13905); l, *R. amundsenianum* (Schneider 906); m, *R. fastigiatum* (Rock 24973); n, *R. flavidum* var. *flavidum* (Stevens 347); o, *R. impeditum* (Rock 23720); p, *R. polycladum* (McLaren D.265); q, *R. orthocladum* var. *orthocladum* (Ward 5065); r, *R. minyaense* (Rock 17726); s, *R. bulu* (Ward 5644); t, *R. telmateium* (Rock 5597); u¹, *R. nivale* subsp. *nivale* (Ludlow & Sherriff 15058); u², *R. nivale* subsp. *boreale* (Rock 9957); u³, *R. nivale* subsp. *australe* (Rock 9519); v, *R. burjaticum* (Malyshev 4600); w, *R. lapponicum* (Nannfeldt & Pilat s.n.); x, *R. capitatum* (Rock 12191); y, *R. russatum* (Rock 9194); z¹, *R. rupicola* var. *rupicola* (Rock 8949); z², *R. rupicola* var. *muliense* (Rock 17967). All × 1½.

the size and shape of the leaves, and in the colouring of their lower surfaces, has led to a number of forms being given specific rank. However, the much fuller range of material now available shows that *R. ravum*, *R. cheilanthum* and *R. sclerocladum* are all within the range of variation of one species. The last of these species was originally regarded as bicolorous, but a proportion of darker scales is not unusual in *R. cuneatum*. *R. cheilanthum* was distinguished by its smaller, rounded leaves with brighter tomentum, and smaller flowers with relatively short styles. In Stevenson (1930), *R. ravum* is keyed from *R. cuneatum* by the pubescence of the style, which is supposed (following Balfour's original description) to be lacking from the style of *R. cuneatum*. However, in 1919, when comparing *R. cheilanthum* with *R. cuneatum*, Balfour acknowledged his error in describing the style of *R. cuneatum* as glabrous.

The foliage of *R. cuneatum* is frequently described as aromatic, Forrest remarking on the oily fragrance resembling orrisroot. However, some individuals are said to lack fragrance. This species inhabits pine and oak forests and forms thickets on the slopes and rocky cliffs above them. It appears to be characteristic of limestone mountains. It ranges in altitude from 3–5000 m.

NATURAL HYBRIDS. *R. cuneatum* x *R. hippophaeoides* [Rock 10552—E, K, US]. Yü 10689 (A, BM, E) represents a hybrid between *R. cuneatum* and an undetermined species. Ward 5030, p.p. (E) and 5129 (E) probably represent hybrids between *R. cuneatum* and a species of another Section.

2. *R. tsaii* Fang in Contr. Biol. Lab. Sci. Soc. China 22:66 (1939).

Type. Yunnan, Chao-tung Hsien, 2900 m, 19 v 1932, Tsai 50928 (holo. A; iso. E).

Small shrub with narrowly elliptic or oblong-lanceolate leaves, 6–12 mm long. Undersurface of the leaf densely covered with uniform buff scales. Calyx lobes small (to 1.0 mm long) lepidote on the outer surface and on the margin and with a few marginal cilia. Stamens 4–7, shorter than the corolla, filaments glabrous. Style shorter than the stamens.

Shrub up to 30 cm high. Branches of the current year greyish lepidote. Leaves dispersed on long shoots or crowded at the ends of stunted shoots, petiole 0.5–1.5 mm, densely grey lepidote, blade 6–12 x 2.5–5 mm, narrowly elliptic or oblong-lanceolate (fig. 3b), apex sub-acute or obtuse, slightly mucronate, base cuneate, margin sub-revolute, mid-rib channelled above, very obscure below, upper surface dull grey-green with contiguous pale scales, under surface uniform buff, densely covered with overlapping pale scales with a fawn periphery and a darker gold centre. Inflorescence 3–7-flowered, pedicel 1–2.5 mm long, pale lepidote. Calyx 0.8–1.0 mm long, lobes rounded, densely pale lepidote, especially below, margin lepidote and with a few cilia, (fig. 2A). Corolla pale "purplish white", broadly funnel-shaped, tube 2–2.8 mm long, lobes 2.5–4 mm long, slightly pubescent within, elepidote outside. Stamens 4–7, shorter than the corolla, about 4 mm long, filament glabrous. Ovary 1.3 mm long with a very narrow basal pubescent band, otherwise densely pale lepidote. Style 2 mm long, slightly shorter than the stamens, glabrous. Stigma truncate. Capsule unknown.

YUNNAN: known only from the type collection (fig. 6).

Tsai recorded that this species is very common, growing on open moss land at 2900 m. The closest relationship is with *R. hippophaeoides* from which it differs in the smaller leaves, and the small number of stamens, which lack basal hairs, a condition unique in the section. Further collections from this population might reveal variation in these characters. We find that the number of stamens in the type gathering varies from 5-7, and that the corolla tube is slightly pubescent on the inside although described by Fang as glabrous.

NATURAL HYBRIDS. The range of *R. hippophaeoides* approaches closely to that of *R. tsaii*. Two specimens collected by Handel-Mazzetti (nos. 1506—E, K, and 2217—A, E, K, US) and one by Schneider (953—A, K) in the region lying immediately to the west of the type locality of *R. tsaii*, but across the Yangtze River in Szechuan, are intermediate between these two species and we consider them to be natural hybrids. Their foliage has the character of *R. tsaii* and in one of them (*Handel-Mazzetti* 1506) the flowers have only eight stamens, the stamens are hairy at the base and the tube of the corolla is pubescent on the inside.

3. *R. intricatum* Franchet in Journ. Bot. Paris 9:395 (1895).

Syn.: *R. blepharocalyx* Franchet, l.c., 396 (1895).

R. peramabile Hutch. in Gard. Chron. 91:366 (1932).

Type. Szechuan occidental, aux environs de Tongolo, *Soulié* 765 (holo. P; iso. K, US).

Compact low shrub with elliptic or rotund leaves about 6-12 mm long. Underside of leaves covered with uniform buff or straw-coloured scales. Calyx lobes small (up to 2 mm) sometimes with a few pale scales, margin lepidote and sometimes also ciliate. Corolla with a narrow tube. Anthers filling the mouth of the corolla tube, style shorter.

Shrub up to 1.5 m, compact and intricately branched. Branches of the current year covered in pale to golden brown scales which darken with age, either elongate with dispersed leaves, or stunted with leaves crowded at the ends; petiole (1-)2-3 mm long, densely lepidote with pale scales; blade (4.8-)6-12(-14) × (2.7-)3.5-7.0(-8.0) mm, oblong to elliptic or rotund (fig. 3c) apex rounded, usually mucronate, the mucro short and stout often recurved or obscure, rarely absent, base cuneate to rounded, margin revolute, often bearing branched hairs, mid-rib usually moderately prominent below, sometimes flat and scarcely visible, grooved above, upper surface dull green covered with scales with golden centres and translucent peripheries, their edges touching to overlapping or slightly discontinuous, under surface uniformly buff to straw-coloured, scales contiguous to overlapping or slightly discontinuous with the grey-green papillate leaf surface visible, uniform in colour with centres of pale gold and translucent periphery. Inflorescence (1-)2-6(-8)-flowered, pedicel up to 5 mm long, pale lepidote. Calyx 0.5-2.0 mm long, lobes deltoid to oblong, the surface glabrous, or with a few pale scales, the margin lepidote with pale gold scales, sometimes also with short and/or long marginal hairs (fig. 2M). Corolla pale lavender to dark blue and deep indigo, rarely yellow, shortly pubescent within the throat, elepidote, tube narrow 4-6(-7) mm long, lobes 4-6(-7) mm long. Stamens (9-)10(-11) hairy near the base, (3.8-)4-6(-7) mm long. Ovary about 1.5-2.0 mm long,

with a pubescent band at the base, pale lepidote above; style 0.5–1.3 (–1.5) mm long, shorter than the stamens; stigma truncate. *Capsule* ovoid, about 5 mm long, lepidote; calyx persistent.

SZECHUAN, YUNNAN: from the vicinity of Tatsienlu to Muli, Kulu and around Yungning (fig. 6).

Forrest 16270 (BM, E); 16270B (E); 17036 (E); 17073 (E); 20450 (E); 20970 (E); 20977 (BM); 21028 (BM, E); 21031 (E, F); 21248 (BM, E); 21344 (E); 29266 (F); *Headfort* 154 (type of *R. peramabile*—K); *Rock* 5544 (A, E, US); 16017 (A, E, NY, US); 16221 (E, US); 17477 (A, E, K, US); 17478 (E, US); 17557 (E, US); 17577 (E); 17663 (E, US); 17751 (E, NY, US); 17961 (E, NY, US); 18144 (E, US); 18222 (A, E); 23925 (A, BM, E, K, NY); 23971 (A, BM, E, F, K, NY, US); 24446 (A, BM, E, F, K, NY, US); *Smith* 11063 (UPS); 12375 (UPS); 12883 (UPS); 13922 (UPS); *Soulié* 187 (E, P); 330 (P); 398 (type of *R. blepharocalyx*—E, K, P); 614 (E); 965 (P); *Ward* 4184 (E); 5092 (E); 5128 (E); 5128A (E); 5135 (E); *Wilson* 3466 (BM, E, K); 3934 (A, K); *Yü* 5632 (A).

Franchet described *R. intricatum* in 1895 from specimens collected by Soulié near Tatsienlu in 1893. The sheet with the type number (*Soulié* 765) in the United States National Herbarium bears two specimens which we have labelled A and B. Specimen A is typical of the species in habit and foliage characters, but the inflorescence is 1-flowered, the corolla is lepidote, with a short tube, the style exceeds the stamens, is much longer than the ovary, and sometimes bears basal hairs and scales. Specimen B is more typical in its floral characters, having an elepidote narrowly tubular corolla and a short glabrous style, but the stamens are a little longer than in other specimens of *R. intricatum* and are not included in the tube. The specimen of the type in the Paris herbarium unfortunately is very poorly preserved and does not show floral characters. However, the original description emphasizes the very short style.

R. intricatum belongs to the group of species with a uniformly pale under-surface to the leaf. It resembles *R. hippophaeoides* in this respect, but is readily distinguished from it by the length of its style which is shorter than the ovary and included within the corolla tube. The stamens also are shorter than in other species of the section and generally reach only to the mouth of the tube so that the anthers fill the opening. The shape of the corolla also is distinctive in its narrow tubular form, with spreading lobes, features found elsewhere in the Section only in *R. complexum*.

Franchet described *R. blepharocalyx* at the same time as *R. intricatum*, distinguishing it from that species by the fringed margins of its calyx lobes, which, he stated, bear no scales. Examination of the type specimens does not confirm this distinction. The margins of the calyx lobes of *Soulié* 398 may be either lepidote or ciliate, or a variable combination of the two. In Stevenson (1930), Hutchinson describes *R. blepharocalyx* as having 5 stamens, a feature which is not recorded in the original description nor upheld by dissection of the type specimen. *R. blepharocalyx* and *R. intricatum* were both collected by Soulié in the neighbourhood of Tongolo, and since they agree in all characters, they are considered to be synonymous.

R. peramabile was described by Hutchinson from garden specimens grown at Kells in Ireland. He compared it with *R. intricatum* from which it was considered to differ in its larger size. An examination of the type in the Kew herbarium reveals that *R. peramabile* shares all the characteristics of *R. intricatum* and there is no doubt that these are conspecific.

R. intricatum occurs at altitudes between 2800–4900 m on open, moist or swampy meadows, on grassy hillsides and on the margins of conifer forests.

R. intricatum was introduced into cultivation by Wilson in 1904 and was raised at Veitch's nursery (Bot. Mag. t. 8163, 1907; Gard. Chron. 41:202, 1907; Schneider, Ill. Handbuch Laubholz. p. 470, 1907). It is now well established in horticulture.

NATURAL HYBRID. *R. intricatum* x *R. telmateium* [Ward 5158 E].

4. *R. hippophaeoides* Balf. f. & W. W. Smith in Notes R.B.G. Edinb. 9:236 (1916).

var. *hippophaeoides*

Syn.: *R. fimbriatum* Hutch. in Gard. Chron. 91: 438 (1932).

Type. Yunnan, mountains west of the Tengku valley, 3650 m, Forrest 12562 (holo. E; iso. K).

Erect shrub with elliptic to oblong leaves about 12–25 mm long. Under surface of the leaf densely covered with uniform yellowish buff scales. Inflorescence with several flowers on rather long pedicels (to 7 mm long). Calyx lobes small (to 1.8 mm long) rather sparsely lepidote on the back, margin with some scales and sometimes ciliate.

Shrub up to 1.25 m, erect. Branches of the current year usually elongated, covered in fawn scales. Leaves dispersed along the shoots, petiole (1.8–)2–4(–5) mm long covered in pale scales; blade (8–)12–25(–30) × (4–)5–10(–11) mm, elliptic to oblong (fig. 3d¹), apex rounded or obtuse, shortly mucronate, base narrowed into the petiole, margin flat to sub-revolute, mid-rib channelled above, slightly raised below, upper surface grey-green with numerous pale scales, under surface yellowish buff, scales overlapping, uniformly pale gold to straw and transparent. Inflorescence 4–7-flowered, pedicel 2.5–7 mm long, pale lepidote. Calyx very short, up to 1.8 mm long, lobes often unequal, rounded to broadly deltoid, usually rather sparsely pale lepidote on back, rarely pubescent, margin pale lepidote, sometimes ciliate (fig. 2F, G). Corolla bright rose or lavender-blue to bluish purple, or deep purple, rarely white, broadly funnel-shaped, tube 4–6.5 mm long, lobes 6.5–8.5 mm long, clepidote, pubescent in the throat, rarely slightly pubescent on the outside. Stamens 10, shorter than the corolla, 4–10 mm long, filaments hairy near base. Ovary 1.8–2.5 mm long, densely pale lepidote with a pubescent basal band. Style 4–10.5 mm, slightly shorter than, to slightly longer than, the stamens, glabrous, or occasionally with some pubescence near the base, coloured. Stigma discoid. Capsule narrowly ovoid, 5–6 mm long, lepidote; calyx persistent.

YUNNAN, SZECHUAN: from Bei-ma-shan and Muli southwards to Talifu and eastwards to Wuluho (fig. 6).

Ching 21962 (A); Feng 890 (A); 902 (A); 2524 (A); Forrest 10333 (A, E, K); 11487 (E); 12461 (BM, E); 12633 (BM, E); 13791 (E); 13792 (E); 13793 (E); 13794 (BM, E); 13799 (E); 13800 (E); 13842 (BM, E); 15251 (E); 15264 (E); 15265 (E); 15388 (E); 15450 (BM, E); 15459 (E); 16128 (E); 16263 (BM, E); 21305 (BM, E); 23098 (BM, E); 23101 (BM, E); 23149 (E); 23346 (BM, E); Goodspeed 32/1846 (E); Headfort 166 (type of *R. fimbriatum*—E, K); McLaren P37 (BM, E); K37A (E); P41 (BM, E, K); Rock 3455 (A, E, US); 3498 (A, E, US); 3897 (A, E, US); 3974 (A, E, US); 5123 (A, E); 6830 (E, US); 8208 (A, E, US); 8494 (A, E, US); 8495 (A, E, US); 8527 (A, E, K, US); 9754 (A, E, K, US); 11363 (E); 11364 (A, E, K); 11365 (E, US); 17203 (A, E, NY, S, US); 17283 (A, E, NY); 17359 (E,

NY); 24701 (A, BM, E, F, NY, US); 24729 (A, BM, E, F, NY, US); 25046 (A, BM, E, F, NY, US); 25402 (A, E, K, NY); *Schneider* 3481 (A, E); 3538 (A, E); *Ward* 269B (E); 5035 (E); 5287 (E); *Yü* 5135 (A); 11195 (A); 11344 (A); 11662 (A); 13845 (A, BM, E); 13937 (A, BM, E); 15010 (A, BM, E).

First collected by Kingdon Ward in May 1913. In July of the same year Forrest collected mature seed and it was through him that this important horticultural shrub was introduced into cultivation (see Stapf and Bean in *Bot. Mag.* t. 9156, 1926 and *Gard. Chron.* 71:87, 1922). The characters of ciliate calyx, longer style and purple flowers used to separate *R. fimbriatum* Hutch. are all within the range of *R. hippophaeoides*. *R. hippophaeoides* grows most frequently between 3000 m and 4000 m, but is recorded as low as 2400 m and as high as 4800 m. It grows most frequently on open slopes and plateaux, commonly on marshy sites in limestone regions, and forms alpine thickets and extensive carpets. It also occurs in mixed forests and pine woods. In his *The Ancient Na-Khi Kingdom of Southwest China*, Rock (1947) writes of his journey from T'o-k'o-sher to the Feng-k'o ferry (p. 237) "The forest changes now, for the sombre spruce and oak give place to larches clothed in the fresh green of their spring foliage, framing a lovely meadow called Ngo-Khü gko (Nme pool). Lavender rhododendron bushes (*Rhododendron hippophaeoides*) grow in the marshy part of the meadow, while large pink-flowered ones, *R. adenogynum*, *R. sigillatum* and *R. orthocladum* frame the rich green sward, full of primulas, anemones and lady's slippers, at an elevation of 12,600 ft. This fairy spot is situated at the foot of a mighty limestone range called La-bu Ngyu or La-pao shan".

var. occidentale Philipson & Philipson, var. nov.

A *R. hippophaeoides* var. *hippophaeoides* distinctum stylo longo gracillimo (ad 13–16 mm longum), minore inflorescentiae numero florum, foliisque angustioribus squamis subter ornatis plerumque fuscioribus minusque dense congestis.

Type. Yunnan, mid-west, Chienchuan-Mekong divide, vi 1923, *Forrest* 23341 (holo. E; iso. BM).

Distinguished from *R. hippophaeoides* var. *hippophaeoides* by the long tenuous style (up to 13–16 mm long), by the smaller number of flowers in the inflorescence, and by the narrower leaf (fig. 3d^b) with usually darker and less densely congested scales on the underside.

YUNNAN: between the Mekong and Yangtze Rivers from Wei-hsi to the Chienchuan plateau (fig. 6).

Forrest 21462 (BM, E); 21476 (BM, E); 23005 (E); 23109 (E); 23343 (E); 25497 (E); *Rock* 11315 (A, E, US); 18458 (NY).

Occurs from 3500–4250 m on open stony slopes. The greater part of the range of this variety lies within the western part of the range of var. *hippophaeoides*, but it also extends nearer to the Mekong River.

NATURAL HYBRIDS. *R. hippophaeoides* var. *hippophaeoides* x *R. cuneatum* [*Rock* 10552 E, K, US]. *R. hippophaeoides* var. *hippophaeoides* x *tsaii* [*Handel-Mazzetti* 1506 E, K; 2217 A, E, K, US; *Schneider* 953 A, K]. *R. hippophaeoides* x *R. orthocladum* [*Rock* 8974 A, E, US].

5. *R. thymifolium* Maxim. in Bull. Acad. Imp. Sc. St. Petersburg. 23:351 (1877).
Syn.: *R. polifolium* Franchet in Journ. Bot. Paris 9:397 (1895).

R. spilanthum Hutch. in Rhodo. Soc. Notes (1929-31) 3, No. 5:287 (1932).

Type. Kansu, ann. 1873, Przewalski s.n. (holo. LE; iso. E, K).

Erect low shrub with elliptic or lanceolate leaves about 5-12 mm long. Under surface of the leaf densely covered with pale fawn scales (rarely a few darker). Lavender or purplish flowers usually solitary. Calyx lobes small (to 1 mm long), more or less pale lepidote, margin lepidote and with long cilia.

Shrub up to 1.25 m, erect, openly branched or fastigiate with the main stem often bearing clusters of numerous short branches. Branches of the current year usually elongate, covered in rufous-brown scales. Leaves dispersed along the long shoots or crowded at the ends of short shoots, petiole 0.7-2(-2.5) mm long, pale to amber lepidote, blade (3-)5-12(-13.5) × (1.8-)2-5(-6) mm, elliptic, oblong or narrowly obovate to lanceolate or oblanceolate (fig. 3e) apex obtuse, usually shortly mucronate, base narrowly cuneate to decurrent on the petiole, margin flat to sub-revolute, mid-rib indistinctly channelled above, slightly raised below, upper surface dull dark green with numerous pale scales, under surface uniformly straw-coloured with contiguous to overlapping pale fawn scales, rarely with a few amber scales intermingled. Inflorescence 1-(2)-flowered; pedicel short (0.5-2.0 mm, slightly longer in fruit), pale lepidote. Calyx 0.5-1.2 mm, or rim-like, lobes rounded to deltoid, often coloured rose, with pale scales sometimes confined to the base, margin usually with scales, often with few to many long cilia intermingled (fig. 2f). Corolla pale lavender-blue to deep purplish blue, broadly funnel-shaped, pubescent in the throat, rarely sparingly lepidote on the outside; tube (2-)3-4 mm long, lobes 5-7 mm long. Stamens 10, rarely 8-12, longer than the corolla, (6-)9-11 mm long, hairy near the base. Ovary 1.5-2.5 mm, with a narrow basal pubescent band, otherwise pale lepidote. Style length variable, short (3-5.8 mm) or long (10-16 mm), glabrous or very rarely with a few hairs or scales, reddish. Stigma discoid. Capsule ovoid, 3-3.5 mm long, lepidote; calyx persistent.

KANSU, TSINGHAI, SZECHUAN: collected from two areas, one in western Szechuan between Muli and the neighbourhood of Tatsienlu (including the Minya Konka Snow Range), the other in southern Kansu from the Min-Shan northwards to the Richthofen (Nanshan) Range (fig. 7). The intervening region has been inadequately explored botanically and we have seen no specimens of Section *Lapponicum* from there (except that of Harry Smith 2601, *R. capitatum*). The two areas of the species, therefore, may be linked by future exploration.

Chiao 1843 (A, S); Ching 523 (A, E, NY); 608 (A, E, NY, US); Cunningham s.n. (1923) (E); Fang 3604 (A, E, K); 3693 (A, E); Farrer 510 (E); Licent 4530 (GB, K); McLaren AF 475 (E); Mussot 266 (A, P); Pratt 787 (A, BM, E, K, P); Rock 6460 (type of *R. spilanthum*—A, E, US); 6473 (A, E, K, US); 12368 (A, UPS); 12370 (A, US); 12411 (A, E, K); 13303 (A, E, K); 13598 p.p. (A); 13904 (A, E); 17519 (A, E, NY, US); 17703 (A, E, K, NY, US); 23734 (A, E, F, NY, US); 24320 (A, E, NY); Smith 12945 (GB); 13008 (GB); Soulié 486 (P); 886, p.p. (E); ann. 1893, s.n. (type of *R. polifolium*—E, K, P); Stevens 351 (A); Ward 5140 (E); 5161 (E); Yü 5981 (A); 6066 (A); 14803 (A, BM, E).

This species was first collected in 1873 by Przewalski in Kansu. So far as we can ascertain it is not at present in cultivation in Britain or America, and

we have found no published record of its introduction. It occurs at lower altitudes than most species of Section *Lapponicum* but it is also recorded at high levels (2600–4600 m). It grows as a shrub layer under pines and also on open alpine slopes. The foliage is recorded as aromatic. Variable characters include habit, which is either a finely branched open shrub or fastigate with dense side branches often bunched along the stout erect stems. In specimens from more exposed sites the leaves are more coriaceous and smaller (e.g. specimens from Minya Konka). A few darker scales rarely occur among the otherwise uniformly pale underside of the leaves. Some plants have long-styled flowers, while in others the style is less than half as long. In the original description of Maximovicz the calyx is recorded as being deciduous but we find this not to be the case.

Franchet distinguished his *R. polifolium* mainly by the two-flowered inflorescences grouped at the ends of the branches, but this character alone is insufficient to distinguish a species when other characters are not correlated with it. Hutchinson does not compare *R. spilantherum* with *R. thymifolium*, but the type specimen (Rock 6460) agrees with that species in all respects.

NATURAL HYBRID. *R. thymifolium* \times *R. telmateium* [Rock 17489—A, E, NY, US].

6. *R. websterianum* Rehder & Wilson in Sargent, *Plantae Wilsonianae* 1:511 (1913).

var. *websterianum*

Type. Szechuan W, north of Tachien-lu, Ta-pao-shan, 4100–4900 m, 7 vii 1908, Wilson 1225 (holo. A; iso. BM, E, K).

An erect shrub with ovate or oblong-elliptic leaves 6–15 mm long. Under surface of the leaf densely covered with contiguous buff-coloured scales. Inflorescence usually with a single light purple flower. Calyx lobes large or moderate (3–4 mm), membranous, usually coloured, lepidote and minutely fringed.

Shrub up to 1.5 m, erect, much branched, fastigate. Branches of the current year elongated or stunted, greyish lepidote. Leaves mainly clustered at the ends of the shoots, petiole 1.5–4.0 mm long, densely pale lepidote, blade 6–15 \times 3–9 mm, ovate or oblong-elliptic to ovate-lanceolate (fig. 3f¹), apex obtuse, emucronate, base cuneate to decurrent on the petiole; margin sub-revolute, mid-rib indistinct or slightly channelled above, very slightly raised below, upper surface dull dark greyish green with contiguous to discontinuous translucent pale scales, under surface straw-coloured, densely covered with contiguous pale scales, periphery translucent and centre cream or straw-coloured. Inflorescence 1–(2)-flowered, pedicel 1–2 mm long, pale lepidote. Calyx 2.8–5 mm, lobes broadly rounded or strap-shaped, sometimes irregular, membranous, usually coloured, margin thickly or sparingly ciliate, sometimes with a few marginal scales, the centre with a band of pale scales, (fig. 1F). Corolla light purple, funnel-shaped; tube 4.5–7 mm long, pubescent in the throat, and sometimes on the outside; lobes 9–12 mm long, elepidote. Stamens 10, about equal to the corolla, 11–16 mm long, hairy near the base. Ovary 2–2.5 mm long, with a narrow basal pubescent band, otherwise pale

lepidote. *Style* 14–17 mm long exceeding the stamens, with some pale scales and slightly pubescent, reddish purple. *Stigma* discoid. *Capsule* ovoid, 4–5 mm long, densely lepidote; calyx persistent.

SZECHUAN: known from south-west of Tatsienlu to Ta-p'ao-shan (fig. 8). *Pratt* 267 (K); *Rock* 17490 (E); *Soulié* 886 p.p. (P); *Stevens* 239 p.p. (F); *Wilson* 3462 (A, BM, E, K, US).

First collected by Soulié. It is doubtful whether this species is in cultivation. The region to the north of Tatsienlu has been inadequately collected, so that the range may not be so restricted as present knowledge indicates. The large coloured calyx indicates relationship with the neighbouring *R. nitidulum* and *R. minyaense*. From these it is distinguished by the upright fastigate habit with new growth established at the time of flowering, and by the uniform light buff scaling on the under side of the leaf. In the type specimen the calyx lobes are smaller (c. 3 mm long), often more irregular in shape, and with more marginal scales than in the specimen from Ta-p'ao-shan (c. 4–5 mm). The species ranges in altitude from 3300–4900 m, occurring on heaths and moorlands.

Rehder & Wilson record that this species is named in honour of "Mr Frank G. Webster of Boston, as a slight mark of appreciation of his constant generosity to the Arnold Arboretum and of his valuable help in the arrangement of its Chinese expeditions".

var. *yulongense* Philipson & Philipson, var. nov.

A *R. websterano* var. *websterano* distinctum inferiore foliorum pagina colore fulvo tincta floribusque flavis vel albis.

Type. Szechuan, Yulong-Ksi, Minya country, S of Tatsienlu, vii 1929, *Rock* 17492 (holo. E).

Distinguished from *R. websteranum* var. *websteranum* by the golden-brown colour of the lower surface of the leaf (fig. 3f²) and by the yellow or white flowers, which are occasionally lepidote on the outside of the lobes.

SZECHUAN: in the Yulong Valley, Minya Country, south-west of Tatsienlu. *Rock* 17470 (E).

Known from two collections made by Joseph Rock in 1929, who noted that it was abundant and the only species in the Chengtsi valley. It forms a shrub up to 90 cm tall and grows in grasslands between 4300 and 4770 m. Its range lies within the southern part of that of var. *websteranum* and to the east of that of *R. minyaense*. These three taxa form a closely knit group which has been inadequately collected.

7. *R. nitidulum* Rehder & Wilson in Sargent, *Plantae Wilsonianae* 1:509 (1913).

var. *nitidulum*

Syn.: *R. nitidulum* var. *nubigenum* Rehder & Wilson, l.c.: 510 (1913).

Type. Szechuan W, Mupin, 3300–4000 m, vi 1908, *Wilson* 3458 (holo. A; iso. BM, E, K).

Much branched low shrub with ovate or elliptic leaves about 5–11 mm long. Under surface of the leaf densely covered with pale to medium dark golden

scales. Inflorescence with one or two lilac or purple flowers; calyx lobes variable, often strap-shaped, to 3 mm long, membranous, lepidote, margin ciliate, sometimes also with scales.

Shrub up to 1.3 m, much branched, erect or ascending. Branches of the current year short, covered in reddish-brown scales. Leaves clustered at the ends of stunted shoots, petiole 0.8–2.0 mm long, densely rufous lepidote, blade 5–11 × (2.5–)3–7 mm, ovate or elliptic (fig. 3g¹), apex obtuse or rounded, mucro absent or obscure, base truncate or broadly cuneate, margin sub-revolute, mid-rib indistinctly channelled above, slightly raised below, upper surface dull dark green with contiguous to discontinuous translucent pale scales, sometimes puberulous, under surface uniformly fawn, with contiguous or discontinuous pale to medium dark reddish gold scales. Inflorescence 1–2-flowered; pedicel 0.5–1.5 mm long, densely rufous lepidote. Calyx (1.5–)2.5–3 × 1.25–1.5 mm, lobes strap-shaped, rounded, or irregularly lobed, equal or variable in size, membranous, usually coloured, margins ciliate, sometimes also with marginal scales, a narrower or broader band of pale scales up the centre, sometimes puberulous, (fig. 2H). Corolla rosy-lilac or violet-purple, funnel-shaped; tube 4–5 mm long, pubescent in the throat; lobes 8–10 mm long, lepidote. Stamens (8–)10, about equal to the corolla or slightly longer, 10.8–12.4 mm long, hairy near the base. Ovary 2–2.5 mm long, with a narrow basal pubescent band, otherwise pale lepidote. Style 11.5–15 mm long, exceeding the stamens, pubescent or glabrous, reddish purple. Stigma capitate. Capsule ovoid, 5 mm long, lepidote; calyx persistent.

SZECHUAN: known from near Tatsienlu and Mupin (fig. 8).

Smith 12882 (GB); Wilson, Veitch expedition 3935 (A, BM, K); 3461 (A, BM, E, K).

Collected by Wilson near Tatsienlu in 1903. In 1908 Wilson again collected it in the same locality and also near Mupin. *R. nitidulum* is a smaller leaved shrub than the neighbouring *R. minyaense* and the sympatric *R. websteranum*. The calyx is not as large as in *R. minyaense* and it varies in its development in different plants and even in different flowers of the same plant. The foliage is described as aromatic. It ranges from 3300–5000 m in altitude and occurs on moorlands. The specific name "refers to the conspicuous glistening gland-like centre of the scales on both sides of the leaf".

var. *omeiense* Philipson & Philipson, var. nov.

A *R. nitidulo* var. *nitidulo* distinctum foliorum apicibus manifestius mucronatis (fig. 3g²) squamisque obscurioribus inter squamas aureas inferioris folii paginae plerumque interpositis, lobisque calycis plerumque brevioribus [0.5–1.5(–2.5) mm longis].

Type. Szechuan, Mt. Omei, 3300 m, vii–viii 1931, Wang 23448 (holo. A; iso. E).

Distinguished from the preceding by the more prominently mucronate leaf apices, by the frequent presence of darker scales among the golden scales of the under leaf surface, and by the usually smaller calyx lobes (0.5–1.5(–2.5) mm long).

SZECHUAN: as far as is known, confined to near the summit of Mt. Omei (fig. 8). Chiao & Fan 703 (A); Faber 483 (K, NY); Fang 18982 (E); Henry 8897 (K); Hu 8312 (E); 8321 (E, US); s.n. (US); Lee 3476 (US); Pratt 802 (K); Wilson 3935a (A, BM, K); Yu-shih-Liu 1516 (A).

This plant has been collected relatively frequently because travellers visit the monastery at the summit of Mt. Omei, the holy mountain. However, most of the specimens have been gathered outside the flowering season. It was first collected in 1888 by the Rev. E. Faber but identified as *R. parvifolium* Adams (= *R. lapponicum*; Forbes & Hemsley, 1889; Busch N., 1915; Hultén, 1958). It is recorded from 3200 m to the summit and occurs on rocky slopes and shrubby flats. The Wilson collection (1st July 1903) is without precise locality, as are those of Fang, Henry and Pratt, but they agree with this variety in all essential features. It is probable that the specimen acquired by Kew from Henry was collected by Pratt.

8. *R. complexum* Balf. f. & W. W. Smith in Notes R.B.G. Edinb. 9:222 (1916). Type. Yunnan, Chungtien plateau, 3350–3650 m, *Forrest* 12520 (holo. E; iso. K).

A low shrub with elliptic or ovate leaves, 3.5–11 × 1.8–6 mm. The under side of the leaves uniformly ferruginous. Inflorescence about 3–4-flowered. Calyx small, usually 1 mm or less, margin lepidote and/or ciliate. Corolla narrowly funnel-shaped, stamens usually five not exerted from the corolla tube and style shorter than the stamens, but flowers occur with more stamens and/or a longer style.

A fastigate or rounded much branched shrub, 8–60 cm high. Branches of the current year covered with ferruginous scales. Leaves either dispersed along the shoots or congested at their ends, petiole 0.5–2.0 mm long, densely ferruginous lepidote, blade 3.5–11 × 1.8–6 mm, broadly or narrowly elliptic to ovate (fig. 3h), apex obtuse or rounded, with a slight mucro or emucronate, base cuneate or truncate, margin sub-revolute, mid-rib slightly channelled above, scarcely visible below, upper surface dark green with many translucent scales, under surface uniformly ferruginous (darker speckling in some specimens may be due to fungal infection), densely covered with contiguous scales with tan periphery and reddish brown centre or occasionally the leaf surface visible between the scales. *Inflorescence* 3–4(–5)-flowered, pedicels 0.5–7.5 mm long, with pale or amber scales. *Calyx* usually less than 1 mm long or obsolete, rarely up to 2 mm long, lobes deltoid, rounded or strap-shaped, with scales on the lower part, margin lepidote and/or ciliate, (fig. 2J). *Corolla* pale lilac to rose purple, usually narrowly funnel-shaped, pubescent in the throat and occasionally on the outside of the tube, lepidote; tube 4–6 mm long; lobes 5–7 mm long. *Stamens* 5–6(–8), pubescent in their lower part, (3–)4–6(–7) mm long. *Ovary* 1.3–2.0 mm long, covered with pale scales, with a narrow basal pubescent band. *Style* usually 0.8–2.5(–3) mm long, but occasionally up to 6 mm, and rarely 8 mm long, glabrous or rarely very slightly pubescent. *Stigma* truncate. *Capsule* about 5 mm long, ovoid to sub-rotund, lepidote; calyx persistent and slightly enlarged.

YUNNAN: mountains of the Chungtien Plateau and the Likiang Snow Range (fig. 5).

Feng 1110 (A); *Forrest* 10311 p.p. (A, E); 15159 (E); 15267 (E); 15269 (E); 15392 (E); 15393 (E); 15400 (E); 15642 (E); 16598 (E); 16995 (E); 22968 (E); 22971 (E); 30885 (E); *Rock* 3867 (A, K, US); 3970 (A, US); 8456 (A, E, US); 17281 (A, E, NY, US); 24659 (A, BM, F, K, NY, US); *Yu* 11381 (A); 11385 (A); 11637 (A); 13356 (A); 13740 (A).

This species was first collected in 1913 by Forrest on the Likiang Snow Range (*Forrest* 10311). However, these specimens became mixed with material

of *R. fastigiatum*, so that the distinctness of the species was not recognized until Forrest re-collected it the following year on the Chungtien Plateau (Forrest 12520). As pointed out by Bayley Balfour & Wright Smith, the shape of the corolla and the length of the style are very characteristic. In a few specimens the style is longer than normal, and in Forrest 16995 in addition there are nine stamens. This species is rare in cultivation, and we have found no published information on its earliest introduction. However, Forrest introduced it in 1917 and again in 1931 since his numbers 15392 and 30885, made in those years, are at present in cultivation. Its habitats are alpine screes and rocks or open stony slopes, where it may form expanses of matted dwarf shrubs. It ranges in altitude from 3400–4600 m.

9. *R. yunngingense* Balf. f. in Stevenson, *The Species of Rhododendron* (1930). Syn.: *R. glomerulatum* Hutch. in Gard. Chron. 91:438 (1932).

Type. Szechuan, SW, mountains east of Yung-ning, 4260 m, Forrest 20463 (holo. E).

An erect shrub to about 1 m high with elliptic leaves about 8–20 mm long, the under surface fawn to ferruginous, sometimes with slight darker speckling. Inflorescence several-flowered. Calyx lobes usually 2–3 mm long, but varying from 0.5–6.0 mm, often irregular in the same calyx, slightly lepidote or elepidote, margin long ciliate or with some scales.

An erect rounded shrub up to 1 m or rarely 1.3 m high. Branches of the current year brown lepidote. Leaves dispersed along the shoots, petiole 1.0–3.0 mm long, buff to fulvous lepidote; blade (6–)8–20 × (2–)4–8 mm, elliptic to broadly elliptic or oblong (fig. 3i), apex acute or obtuse, clearly or obscurely mucronate, base cuneate, margin sub-revolute, mid-rib channelled above, raised below, upper surface dull green, bearing contiguous pale scales, under surface fawn to ferruginous, sometimes with slight darker speckling, the scales contiguous or with the grey-green leaf surface visible, pale tan to ferruginous with darker centres, sometimes with darker scales scattered amongst them. Inflorescence 3–4(–6)-flowered, pedicels 2–3 mm long, with fulvous or pale scales. Calyx lobes often irregular in length, usually 2–3 mm long but varying from 0.5–6.0 mm, deltoid to strap-shaped or irregularly lobed, pale lepidote below and up the centre or rarely elepidote, margin usually long ciliate or with some scales (fig. 2B). Corolla deep purplish-blue, rose-lavender, or rarely white, broadly funnel-shaped, pubescent in the throat and rarely on the outside, elepidote; tube 5–6 mm long; lobes 6–8(–10.5) mm long. Stamens 10–(8–12), 9–12.5 mm long, pubescent in their lower part. Ovary 1.5–2.5 mm long, covered with pale scales except for a narrow basal pubescent band, style either 3.5–6 mm or 10–15 mm long, glabrous. Stigma discoid. Capsule ovoid, about 5 mm long, lepidote; calyx persistent.

SZCHUAN, YUNNAN: collected in an area extending from near Muli past Yungning into the Likiang and Hoking Ranges. Also on the Yangtze Mekong divide between 26°40' N and 27°25' N (fig. 9).

Ching 20496 (A); 20599 (A); 20600 (A); 20608 (A); 20862 (A); Feng 1155 (A); Forrest 10035 p.p. (A, E); 16282 (E); 17132 (E); 20460 (E); 20698 (E); 21282 (E); 21290 (E); 21297 (E); 21304 (E); 21313 (E); 22972 (E); 23103 (E); 25526 (E); 29259 (E); 29260 p.p. (E); 29337 (E); McLaren P92 (E); Rock 8278 p.p. (A); 17134 (K); 25370 (A, K, NY).

This species was first collected by Forrest in the Likiang Range in 1913 when it was mixed with *R. fastigiatum*. The first collection of *R. yungningense* made by Rock (no. 8278 in the Sungkwei Hoking Range south of Likiang) was again mixed with *R. fastigiatum*. The species was not recognized for many years, when it was described by Bayley Balfour in 1930, who based it on a later gathering of Forrest (no. 20463) collected in the mountains east of Yungning. It had been introduced into cultivation earlier than this, in 1922, having been raised from seed collected by Forrest (Forrest 21297 and 21304, both from mountains east of Yungning). Plants raised from the former number by Lord Headfort at Kells were described by John Hutchinson in 1932 as *R. glomerulatum*, but this differs in no respects from the previously described *R. yungningense*. Specimens of *R. glomerulatum* taken from the plant at Kells are preserved at Kew and Edinburgh (Headfort 320).

R. yungningense occurs on open alpine slopes often forming low scrub from 3200–4300 m.

The under surface of the leaf is usually rather densely covered with scales which vary from fawn to rich reddish brown, but the scales may be more open revealing the pale leaf-surface, and some darker scales may produce a slight speckled effect. The calyx lobes are very variable, even in the same flower. They are usually deltoid, about 2–3 mm long, with a few scales below and in the centre of the outer surface, and the margins are long-ciliate, but frequently they are smaller or much larger. Plants occur in which the style is shorter than the stamens, while in others it is longer than, or at least more or less equal to them.

NATURAL HYBRID. *R. yungningense* x *R. rupicola* var. *rupicola* [Forrest 29260 p.p. E].

10. *R. tapetiforme* Balf. f. & Ward in Notes R.B.G. Edinb. 9:279 (1916).

Type. Tibet/Yunnan frontier, Ka-gwr-pw, 4550 m, vii 1913, Ward 795 (holo. E).

A low shrub with broadly elliptic or rotund leaves about 4–12 mm long. Under surface of the leaf uniformly rufous. Inflorescence about 3-flowered. Calyx small, up to 2 mm long, usually lepidote, margin lepidote and/or ciliate.

A low matted or rounded densely branched shrub, prostrate or up to 75–90 cm high. Branches of the current year covered with ferruginous scales which darken with age. Leaves mostly crowded at the ends of the shoots, petiole 0.5–2(–3) mm long, densely rufous lepidote, blade 4–12(–17) × (2–)3–8(–9.5) mm, broadly elliptic to rotund (fig. 3j), apex obtuse or rounded, emucronate or with a very slight mucro, base broadly cuneate, margin sub-revolute, midrib inconspicuously channelled above, slightly raised below, upper surface dark green with many translucent scales, under surface uniformly rufous, densely covered with contiguous scales with reddish-brown periphery and a darker centre, or more rarely some leaf surface visible between the scales. Inflorescence 1–3(–4)-flowered, pedicels 1.5–3.0 mm long, with fulvous or pale scales and sometimes puberulous. Calyx obsolete or up to 2 mm long, an irregular rim or with rounded or deltoid lobes, usually with fulvous or pale scales, sometimes elepidote and puberulous, margin either lepidote or ciliate (fig. 2N). Corolla usually purplish or purplish-blue, sometimes violet or rose, exceptionally yellow, broadly funnel-shaped, often with a narrow

basal part to the tube, pubescent in the throat and sometimes on the outside of the tube and more rarely on the lobes, lepidote; tube 3–5 mm long; lobes 6–11 mm long. *Stamens* 10 or sometimes fewer, rarely 5 or 6, pubescent on their lower part, (8–)10–14(–15) mm long. *Ovary* 1.7–2.5 mm long, covered with pale or amber scales, with a narrow basal pubescent band. *Style* usually 11–17 mm long, exceeding the stamens, very rarely shorter (5.5 mm), glabrous or pubescent. *Stigma* discoid. *Capsule* ovoid, 5–7 mm long, lepidote; calyx lobes persistent.

TIBET, BURMA, YUNNAN: confined to the region where Tibet, Burma and Yunnan meet, extending from Ata Kang La eastwards to the Bei-ma-Shan (between 28°–29° N and 97°–99° E) (fig. 5).

Forrest 13965 (E); 14085 (E); 15356 (E); 16450 (E, K); 16577 (BM, E); 19201 (E); 19674 (E); 20208 (E); 20714 (E); *Rock* 8849 (A, E, NY, US); 9248 (A, E, US); 9952 (A, E, US); 11086 (E, US); 11088 (E, US); 11091 (E, US); 11092 (E, US); 11093 (E, US); 11098 (E, US); 11109 (E, US); 11130 (E, US); 22288 (A, BM, E, K, NY, US); 22800 (A, BM, E, K, F, NY, US); 22810 (BM, E); 22829 (A, BM, E, F, NY, US); 22872 (A, BM, E, F, NY); *Ward* 5337 p.p. (E); 5385 (E); 6960 (E, K); 7633 (E, K); 10521 p.p. (A, BM); 10716 p.p. (BM); 13370 (BM); 15005 (E); *Yü* 12314 (A).

This species was first collected in 1913 by Kingdon Ward on the Ka-gwr-pw Range near the Yunnan-Tibet frontier. Although reported to be in cultivation we have found no published record of its introduction, and have seen no plants of it in British gardens. It grows on open alpine slopes and bare screes, ranging in altitude from 3500–4600 m. In his *The Ancient Na-khi Kingdom of Southwest China*, Rock (1947) writes (p. 344) "From here the trail follows the stream, then zigzags to the top of the pass with low scrub (*Rhododendron tapetiforme*) covering the ground. An obo with prayer-flags crowns the pass; to the east massive crags of yellow, weathering rock, identified by Gregory as rhyolite, flank the upper valley, while to the west the gently sloping snow-covered declivities of the Pai-mang Shan become visible. The trail crosses a small plateau with stunted *Rhododendron tapetiforme* bushes and then arrives at a shallow ravine with *Abies* and *Larix* trees and rhododendron undergrowth".

The characters of this species are subject to relatively slight variation, but a specimen collected by Rock (no. 11093) between Atuntze and Pungtzera is recorded as having yellow flowers.

NATURAL HYBRIDS. *R. tapetiforme* x *R. nivale* subsp. *boreale* [*Rock* 9266—US; *Wang* 66464—A]; *R. tapetiforme* x *R. rupicola* var. *rupicola* [*Ward* 10005—E]; *R. tapetiforme* x *R. rupicola* var. *chryseum* [*Forrest* 14074—E, type of *R. chamaezelum* Balf. f. & Forrest).

R. chamaezelum Balf. f. & Forrest (Notes R.B.G. Edinb. 13:241, 1922) is known only from the type collection which was made on the Mekong-Salween divide at 28°26' N. This is within the ranges of both *R. tapetiforme* and *R. rupicola* var. *chryseum*. Since the type specimen displays a unique combination of characters intermediate between these two taxa it is considered to be a hybrid. The most significant characters are the bicolorous scales on the underside of the leaf, the lepidote corolla lobes, the mucronate leaf, and the pale coloration of the corolla.

11. *R. dasypetalum* Balf. f. & Forrest in Notes R.B.G. Edinb. 11:45 (1919). Type. Yunnan, Li-ti-ping, 3500 m, vi 1917, *Forrest* 13905 (holo. E; iso. K).

Shrub up to 75 cm with elliptic or oblong-elliptic leaves 8–15 mm long. Under surface of the leaf densely covered with rufous-brown scales. Inflorescence 2-flowered. Calyx lobes strap-shaped about 3 mm long, puberulous and lepidote, margin long-ciliate. Corolla pilose on the outside.

A much branched shrub up to 75 cm high. Branches of the current year densely covered with brown scales. Leaves mostly crowded at the ends of the shoots, petiole 1–2 mm long, lepidote, blade 8–15 × 3–7.5 mm, elliptic or oblong-elliptic (fig. 3k), apex obtuse or rounded, clearly mucronate, base broadly cuneate, margin sub-revolute, sometimes with a few simple hairs especially near the base and on the petiole, mid-rib channelled above and slightly raised below, upper surface dark green with discontinuous pale scales, under surface uniformly tawny-brown, densely covered with contiguous rufous-brown scales. Inflorescence 2-flowered, pedicels 3–4 mm long, puberulous and lepidote. Calyx 3 mm, lobes broadly strap-shaped, rounded, purplish, pubescent and pale lepidote, especially basally, margin long ciliate, (fig. 2s). Corolla bright purplish-rose, broadly funnel-shaped, pubescent in the throat and pilose on the outside of the tube and lobes, lepidote; tube 4–5(–8) mm long; lobes 8–10 mm long. Stamens 10, 9–14 mm long, pubescent in their lower part. Ovary 2–2.5 mm long, pale lepidote with a narrow basal pubescent band. Style about 15 mm long, exceeding the stamens, purple, pubescent near base. Stigma discoid. Capsule ovoid, c. 5 mm long, lepidote; calyx lobes persistent and slightly enlarged.

YUNNAN: known from a single gathering on the Li-ti-ping. (fig. 6).

The only known specimen was collected in 1917 on open stony pasture at an altitude of 3500 m. It is rare in cultivation, having been introduced in 1917 by Forrest (no. 13905). Plants raised at the Royal Botanic Garden, Edinburgh, match the type specimen closely, although some plants have even larger corollas (up to 20 mm long). Some transference of labels has evidently occurred, either in the field or in the garden, because plants of *R. hippophaeoides* and *R. impeditum* are labelled as *R. dasypetalum*, and plants of *R. dasypetalum* are labelled as raised from Ward 4486 although the herbarium specimen of that number is *R. cuneatum*.

12. *R. amundsenianum* Hand.-Mazz. in Anz. Akad. Wiss. Wien, Math. Nat. Kl. 58:25 (1921).

Type. Szechuan, m. Lose-schan, near Ningyüen, c. 3900–4250 m, 16 iv 1914, *Handel-Mazzetti* 1414 (holo. W; iso. A).

A low shrub with broadly elliptic or rounded leaves 9–18 mm long, with uniform rusty brown scales on the underside of the leaf. Calyx lobes ovate with a central band of scales and a ciliate margin.

A shrub up to 50 cm high. Branches of the current year bearing dark brown scales. Leaves clustered at the ends of the shoots, petiole 1–2 mm long, lepidote, blade 9–18 × 5–9 mm, broadly elliptic or rotund (fig. 3l), apex rounded with a short reflexed mucro, base truncate or broadly cuneate, margin sub-revolute, mid-rib channelled above, raised below, upper surface dull dark green, bearing contiguous amber scales, under surface a uniform



FIG. 4. Map of the Szechuan-Yunnan region showing some of the collecting localities mentioned in the text.

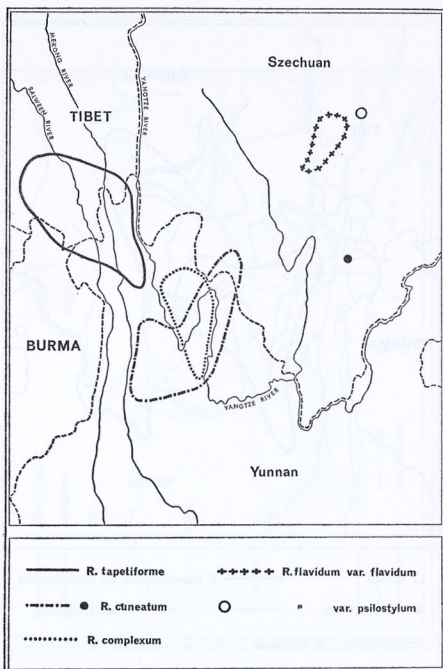


FIG. 5. Distribution of species of *Rhododendron* sect. *Lapponicum*.

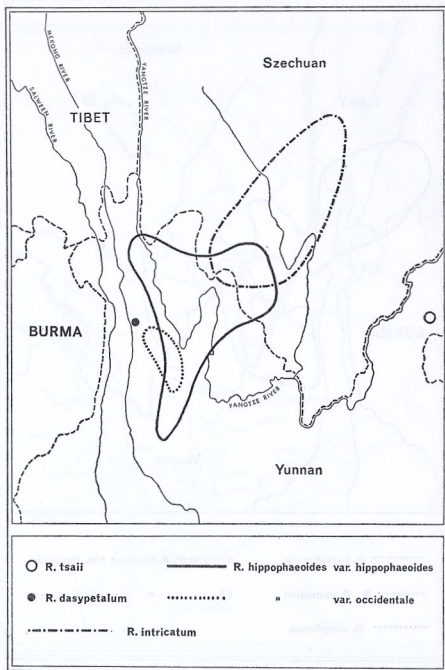


FIG. 6. Distribution of species of *Rhododendron* sect. *Lapponicum*.

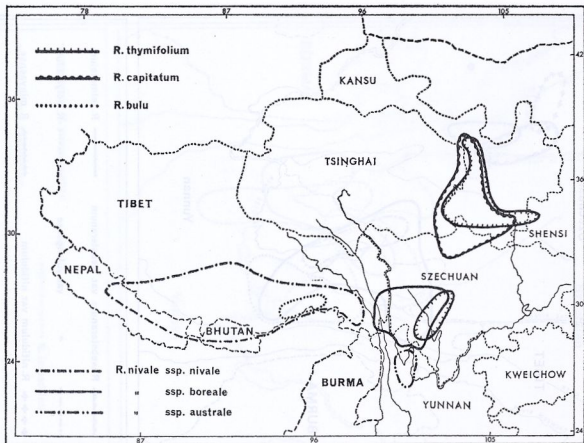
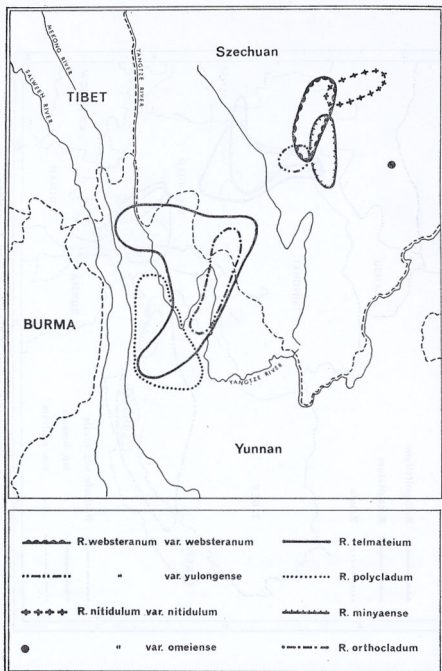


FIG. 7. Distribution of species of *Rhododendron* sect. *Laponicum*.

FIG. 8. Distribution of species of *Rhododendron* sect. *Lapponicum*.

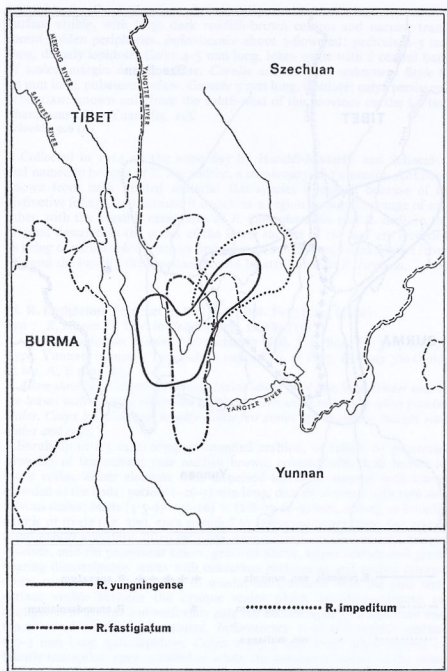
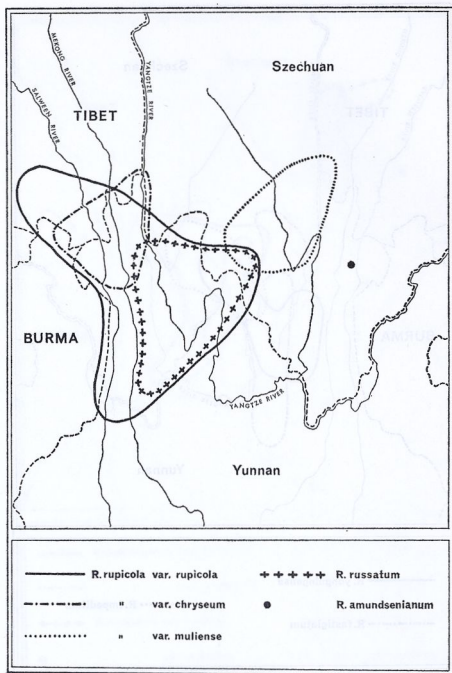


FIG. 9. Distribution of species of *Rhododendron* sect. *Lapponicum*.

FIG. 10. Distribution of species of *Rhododendron* sect. *Lapponicum*.

rusty brown, the scales irregularly contiguous but with some paler leaf surface visible, with large dark reddish-brown centres and narrow translucent golden peripheries. *Inflorescence* about 3-flowered; pedicels 2–3 mm long, densely lepidote. *Calyx* 4–5 mm long, lobes ovate with a central band of scales, margin densely ciliate. *Corolla* and stamens unknown. *Style* to 15 mm long, pubescent below. *Capsule* 5 mm long, lepidote; calyx persistent. SZECHUAN: known only from the south-west of the province on the Lo tieh Shan, near Ning Yuan (fig. 10).
Schneider 906 (A).

Collected in 1914 on the same day by Handel-Mazzetti and Schneider, and named in honour of E. Amundsen, a missionary of Yunnanfu. Although known from such limited material this species is upheld because of its distinctive foliage, and because it occurs in a region beyond the range of any other, with the possible exceptions of *R. hippophaeoides* and *R. tsaili*. In the original description the scales of the lower surface of the leaf are recorded as being of varied colour, but we find them to be uniformly dark. Apart from this and the locality the specimens could be attributed to *R. rupicola*.

13. *R. fastigiatum* Franchet in Bull. Soc. Bot. Fr. 33:234 (1886).

Syn.: *R. nudum* H. Lév. in Feddes Rep. 12:285 (1913).

"*R. capitatum* Maxim." Franchet in Bull. Soc. Bot. Fr. 32:7 (1885).

Type. Yunnan, in monte Tsang-chan, supra Tali, vi 1883, *Delavay* 360 (holo. P; iso. A, E p.p., K).

A low shrub with elliptic or oblong leaves about 7–14 mm long. Under side of the leaves with the pale epidermis visible between uniform opaque often pinkish scales. Calyx lobes oblong, usually with a few scales up the centre, margin with scales and cilia.

Shrub up to 1.5 m, a compact rounded cushion, or tufted, or prostrate. Branches of the current year reddish brown, covered with dark brown to black scales, either elongate with dispersed leaves or stunted with leaves crowded at the ends; petiole 1–2(–3) mm long, densely covered with pale and fulvous scales; blade (4.5–)7–14(–16) × (2.8–)3–6(–9) mm, oblong or broadly elliptic or ovate (fig. 3m), apex rounded to sub-acute, mucronate, the mucro usually short and stout, often recurved, base cuneate or sub-truncate, margin revolute, mid-rib prominent below, grooved above, upper surface dull green bearing discontinuous scales with colourless peripheries and amber centres, under surface fawn to greyish to mushroom coloured with the pale leaf-surface visible between the opaque scales which are discontinuous or contiguous in groups and uniformly pale but becoming more translucent and tan-coloured as the leaf matures. *Inflorescence* 1–3(–4)-flowered; pedicel 0.5–3 mm long, pale lepidote. *Calyx* 2.5–5.5 mm long, lobes oblong or bluntly triangular, apex rounded or acute, the number of scales on the outer surface variable from none to a band of pale scales along the centre, but dense towards the base, margin with pale stalked scales and moderate to long cilia (fig. 2T). *Corolla* from bright lavender blue to pinkish or rich purple, pubescent in the throat and rarely on the outer surface, usually without scales, but rarely with few to many pale scales; tube 3.0–6.5(–8) mm long; lobes (6.5–)7–9(–10) mm long. *Stamens* usually 10, but varying from 6–11,

hairy near the base (9.5–)10–14(–15) mm long. Ovary 2–2.5 mm long with a basal pubescent band, pale lepidote above, occasionally with an apical tuft of hairs; style (11–)13–15(–17) mm long, exceeding the stamens, glabrous or rarely with a little pubescence or a few scales at the base, stigma discoid. Capsule ovoid, about 5–6 mm long, lepidote; calyx persistent.

YUNNAN: from the vicinity of Chungtien southwards past Likang, Chien chuan, Hoking, to south of Tali and the Sung Kwei Pass (fig. 9). The place names Io-shan and Ta-hai-tse (both given by Maire) have not been located on any available map.

Delavay 267 (P); 737 (A, P); s.n. 1886 (E, P); s.n. 1887 (E); s.n. 1888 (P); Forrest 4149 (A, BM, E, K); 5847 (BM, E); 5863 (E, K); 6757 (BM, E); 10284 (E); 10311 p.p. (E); 10610 (A, E, K); 11621 (E); 11626 (BM, E, K); 11654 (E); 15091, p.p. (BM); 15249 (BM); 15612 (E); 15613 (E); 15614 (E); 15615 (E); 15617 (E); 21507 (BM, E); 21532 (BM, E); 21581 (BM, E); 23102 (E); 23113 (E); 23156 (E); 23342 (BM, E); 23344 (BM, E); 25496 (BM, E); 25981 (E); 25982 (E); 28256 (E); 28260 (E); 28287 (E); 28300 (E); 28341 (E); 29112 (E); 30997 (E); Goodspeed 32/1413 (E); McLaren B3 (BM); 44 (BM, E, K); M113 (BM, E); C190 (BM, E, K); Maire 61 (E); 223 (E); s.n. 1911 (E, type of *R. nanum*); Roch 188 (E); Rock 3152 (A, E); 4023 (E, US); 4955 (A); 6334 (US); 6534 (A, E); 8261 (A, E); 8278 p.p. (A); 8285 (A, E, K); 8356 (A, E); 9493 (A, E, US); 9495 (A, E, K, US); 9496 (A, E, US); 11303 (E, US); 24973 (A, BM, E, NY, US); 24976 (A, BM, E, F, G, NY); 25417 (NY).

The first collections were made by Delavay near Tali, and these became the type of the species. Delavay's collection was evidently mixed, because some specimens of the type number (Delavay 360) differ from the type in Paris, being *R. telmateium*.

A second gathering by Delavay (267) was identified by Franchet as *R. capitatum* Maxim. Franchet mistakenly recorded this gathering as Delavay 58, but Dr J. C. Jolinon of the Paris Herbarium has confirmed from Delavay's original list that the number should be 267 (pers. comm.).

R. fastigiatum is frequent in cultivation and has been used in hybridization. An interesting note is found accompanying the plate of *R. scabrifolium* in the *Botanical Magazine* (t. 7159, 1891): "seedlings of it [i.e. *R. scabrifolium*] were obtained by Kew from the Jardin des Plantes in the spring of 1888, which flowered in April 1890. Along with it were received plants of *R. cilicalyx*, *decorum*, *delavayi*, *fastigiatum*, *hybridum*, *lacteum* and *racemosum* all from the same source"—that is, Delavay. *R. fastigiatum* must, therefore, have been introduced to France soon after its discovery. Forrest re-introduced it in 1906. It is frequently confused with *R. impeditum*, which often has a similar habit, has leaves of a similar size and shape, flowers with a similar range of colour and similar calyx lobes. The only reliable feature distinguishing the two species is the type of scaling on the lower surface of the leaf. *R. fastigiatum* has pale opaque scales, often giving a mushroom-coloured appearance to the under surface, whereas *R. impeditum* has darker scales with translucent bright golden peripheries. The ranges of the two species overlap slightly (in the loop of the Yangtze River), but otherwise *R. impeditum* is found further north-east into Szechuan.

R. fastigiatum occurs at altitudes between 3400 and 4400 m on open, stony pastures and screes, on cliffs, and in pine forests.

NATURAL HYBRID. *R. fastigiatum* x *R. rupicola* var. *rupicola* [Rock 25036—BM, E, K].

14. R. flavidum Franchet in Journ. Bot., Paris 9:395 (1895).**var. flavidum**

Syn.: *R. primulinum* Hemsley in Gard. Chron. 47:4 (1910).

Type. Tibet E, Ta-tsien-lou, ann. 1893, Soulié 625 (holo. E).

Erect shrub with minutely pubescent branchlets bearing broadly elliptic or oblong leaves (7–17 mm long). Under side of leaves pale grey-green with well-spaced tan scales. Inflorescence 1–3-flowered, pedicel short (1–4 mm long). Calyx lobes 2–4 mm long, rather narrow, pubescent below, sparsely lepidote and margin ciliate. Corolla minutely pubescent on the outside.

Erect shrub up to 2.5 m. Branches of the current year usually elongate, shortly pubescent, occasionally sparingly lepidote. Leaves mainly clustered at the ends of the shoots, petiole (1–)2–3(–4) mm long with scattered brown scales, blade 7–17.5 × 3–7 mm, broadly elliptic to oblong (fig. 3n), apex rounded and shortly mucronate, base broadly or narrowly cuneate, margin sub-revolute, mid-rib channelled above, sometimes sparingly pubescent, raised below, upper surface dark-green with numerous pale scales, under surface pale grey-green to glaucous with well-spaced scales having a pale tan periphery and a darker centre. Inflorescence 1–3-flowered, pedicel 1–4 mm long, pubescent, sometimes with a few scales. Calyx 2–4(–7) mm long, minutely pubescent below, lobes strap-shaped or deltoid, acute, sometimes unequal, with a few scattered pale or amber scales up the centre or glabrous, margin ciliate (fig. 1G). Corolla yellow, broadly funnel-shaped, pubescent outside and in the throat, tube 4–7 mm long, lobes 8–11 mm long, lepidote, or rarely sparingly lepidote. Stamens (8–)9–10, more or less equal to the corolla in length, 9–18 mm long, filament hairy near the base, hairs often ribbon-like. Ovary 2–3.5 mm long, densely pale lepidote with a pubescent basal band. Style 16–22 mm long, longer than the stamens, pubescent at the base. Stigma discoid. Capsule ovoid, 6 mm long, lepidote; calyx persistent.

SZCHUAN: known from an area extending from Tatsienlu and Tongolo southwards towards Baurong (fig. 5).

Pratt 521 (K, P); Smith 11730 (GB); Soulié 331 (E, K, P); Stevens 152 (F, US); 237 (F); 347 (F); 350 (F); Wilson 1202 (BM, E, US); raised from seed 1773 (type of *R. primulinum* —K); 3932 (BM, K).

First collected by Pratt in 1890 and introduced by Wilson in 1905 to the nurseries of James Veitch & Sons where it first flowered in 1909 and was described as *R. primulinum* Hemsley. Later the same year it was recognized as *R. flavidum* Franchet (Kew Bull. 1910, p. 117 and Bot. Mag. t.8326, 1910). It is still well-established as a garden plant. Wilson notes that it is common in alpine regions around Tatsienlu and that the flower colour varies from pale primrose to clear yellow. It occurs from 3000 to above 4000 m.

A larger shrub with privet-like leaves up to about 3.5 cm long on the upper side of which the lateral veins are visible, and with white flowers about 23 mm long on long pedicels, is known in cultivation (see The Rhododendron Handbook, ed. Syngé, 1967, p. 86). The scales of the under side of the leaf resemble those of *R. flavidum*, the shoots are minutely pubescent, and in other respects except size it conforms to the characters of the species. It is represented in the Kew Herbarium by a specimen grown at Dawyck, Stobo, Scotland in 1930, and is still in cultivation, as for example, in the garden of

E. H. M. and P. A. Cox at Glendoick, Perthshire. We have seen no specimen like it collected in the wild.

var. *psilostylum* Rehder & Wilson in Sargent, *Plantae Wilsonianae* 1:513 (1913).

Syn.: *R. psilostylum* (Rehder & Wilson) Balf. f. in Notes R.B.G. Edinb. 11:104 (1919).

Type. Szechuan, west of Kuan Hsien, summit of Niu-tou-shan, 3300 m, 20 vi 1908, *Wilson* 3452 (holo. A; iso. BM, E, K).

Distinguished from var. *flavidum* by the broader leaves with the scales on the lower side not uniform in colour but with dark widely-spaced scales being intermixed with the shining golden scales, and by the smaller calyx lobes (up to 2 mm long).

SZETCHUAN: west of Kuan Hsien, summit of Niu-tou-shan (fig. 5).

The single gathering made by Wilson in 1908 is difficult to interpret. This area of Szechuan has been very inadequately collected, and until more specimens can be examined it is not possible to decide whether the characters of this specimen represent a local variant of *R. flavidum* or whether they are due to hybridization. The material of this number at Edinburgh appears to include typical specimens of *R. flavidum*.

NATURAL HYBRIDS. A plant raised at Kew from seed collected by Kingdon Ward (no. 4456) was described by Hutchinson as *R. lysolepis* (Notes R.B.G. Edinb. 16:175, 1931). Specimens of it preserved in the Kew and Edinburgh herbaria appear to be of hybrid origin, with *R. flavidum* as one parent. Other specimens raised from the same seed suggest that *R. impeditum* is another component. The herbarium specimen of Ward 4456 at Edinburgh is evidently a hybrid form of *R. impeditum*.

R. flavidum x undetermined species—*Wilson* 3464 (A, type of *R. verruculosum* Rehder & Wilson in *Plantae Wilsonianae* 1:507, 1913).

The plant referred to in *Gard. Chron.* 89:470, 1931 as *R. verruculosum* was probably raised from seed introduced by Wilson. The height of the plant would be compatible with a *R. flavidum* parentage.

15. *R. impeditum* Balf. f. & W. W. Smith in Notes R.B.G. Edinb. 9:239 (1916).

Syn.: *R. litangense* Balf. f. ex Hutch. in Stevenson, *The Species of Rhododendron* 411 (1930). See also Notes R.B.G. Edinb. 7:27 (1929).

R. semanteum Balf. f., l.c.—in synonym.

Type. Yunnan, western flank of the Lichiang range, 3650–3960, vi 1910, *Forrest* 5876 (holo. E; iso. A, K).

A low shrub with elliptic or oblong leaves about 5–14 mm long. Under side of leaves usually with the pale epidermis clearly visible and speckled with brown scales. Calyx usually strap-shaped, thin, with a central band of scales and ciliate at the margin.

A compact much branched shrub up to 90 cm or rarely 120 cm high. Branches of the current year usually pubescent and with dark brown scales which darken with age. Leaves either dispersed along the shoots or congested at their ends, petiole 1–3 mm long, lepidote and sometimes pubescent, blade (4–)5–14 × (2.5–)3–6(–7) mm, elliptic or ovate to broadly elliptic or oblong

(fig. 3, o), apex obtuse or acute, mucronulate, base broadly cuneate, margin sub-revolute, mid-rib channelled above, raised below, upper surface dull green bearing discontinuous pale scales, under surface pale grey-green speckled brown or more uniformly rusty, the scales markedly to only slightly discontinuous, fulvous or amber, the centre often darkening with age. *Inflorescence* to 4-flowered; pedicels 0.8–3 mm long, usually with fulvous and pale scales and rarely pubescent. *Calyx* usually 2.5–4 mm long, occasionally as short as 1.5 (1.0) mm, lobes strap-shaped, with a rounded or deltoid apex, thin, usually with scales forming a scattered central band, margin long-ciliate, often with a few scales (fig. 2U). *Corolla* violet or purple to rose-lavender, or rarely white, broadly funnel-shaped, pubescent in the throat, rarely on the outside, elepidote or with a few scales on the outside of the lobes; tube (2–)3–6 mm long; lobes 5–9 mm long. *Stamens* usually 10, but often variable in number on the same plant (5–11), sometimes all flowers with fewer than 10, pubescent in the lower part, usually 8–15 mm long, sometimes as short as 4 mm. *Ovary* 1.5–2.5 mm long, covered with pale scales except for a narrow basal pubescent band; style variable in length from about 4 mm up to 20 mm, either pubescent at the base or glabrous. *Stigma* discoid. *Capsule* ovoid, 4–6 mm long, lepidote; calyx persistent.

SZECHUAN, YUNNAN: frequently collected in a region extending from the Likiang range north-eastwards past Yungning and Muli to east of the Yalung River, but also occurring infrequently over a much wider area (collected on the Mekong-Salween divide 27°36' N, 98°56' E, *Forrest* 20968; on the mountains east of Chungtien, 27°50' N, *Forrest* 15076; and at Ta-li Hsien, *Wang* 63246, 63259) (fig. 9).

Ching 30126 (A); 30159 (A); *Handel-Mazzetti* 2622 (E); *Forrest* 10035 p.p. (A, E); 10055 (A, BM, E); 10070 p.p. (BM); 15076 (BM); 15091 p.p. (BM); 15201 (BM, E); 16277 (E, K); 16284 (A, E, K); 16292 (E); 16983 (E); 17034 (E); 17035 (E); 17116 (E); 17117 (E); 17118 (E); 20454 (E); 20492 (E); 20968 (E); 20969 (E); 21387 (E); 22108 (E); 22110 (E); 29268 (E); 30941 (E); *Rock* 3505 (E, US); 5536 (A, E, US); 8501 (A, E, US); 11469 (A, E, US); 16044 (BM, E, US); 16115 (A, E, US); 16218 (E, US); 16638 (E, US); 17442 (E, US); 17958 (A, E, NY, US); 18143 (E); 18163 (E); 18223 (A, E, NY, US); 23720 (A, BM, E, F, NY, US); 23784 (A, BM, E, K, NY, US); 23926 (A, BM, E, K, NY); 24278 (A, E, K, NY); 24369 (A, E, NY); 24384 (E, F, K, NY, US); 24460 (A, BM, E, K, NY, US); 24464 (A, BM, F, K, NY, US); *Wang* 63246 (A); 63259 (A); 71172 (A); *Ward* 4186 (E); 4413 (E); 4444 (E); 5130 (E); 5147 (E); 5148 p.p. (E); 5184 (E); *Yü* 7084 (A); 7191 (A); 7244 (A); 13984 p.p. (E); 14444 p.p. (BM, E).

This species was first collected in 1910 by *Forrest* on the western flank of the Likiang Range (*Forrest* 5876). When this collection was named and described in 1916 by Bayley Balfour & Wright Smith a second gathering made in 1910 by *Forrest* (no. 5863) was also cited. This second specimen, however, is of another, previously described species, *R. fastigiatum* Franchet. *Forrest* 5876 is therefore designated as the type specimen of *R. impeditum*. A discussion of the distinction between *R. fastigiatum* and *R. impeditum* will be found under the former species. *R. impeditum* is a common plant in cultivation, where it hybridizes freely with other species of Section *Lapponicum* and also of Subsection *Triflora*. *R. impeditum* was introduced to cultivation at the time of its discovery (Dict. of Gardening, ed. Chittenden, 1951; Gard. Chron. 78:41, 1925; Bot. Mag. N.S. t.489, 1968).

R. litangense was separated from *R. impeditum* on the basis of lighter flower-colour and the sub-persistence of the scales of the flower buds.

Specimens collected in the field show that these features are included within the natural range of variation of *R. impeditum*.

R. impeditum grows in a wide range of habitats. It occurs in forests of *Picea*, *Quercus* and *Rhododendron*, and forms thickets on the open slopes above the forests and on alpine meadows and cliffs. It ranges in altitude between 3300 and 4600 m.

Most specimens of *R. impeditum* may be recognized by the combination of discontinuous brown scales on the underside of the leaf and the thin strap-shaped calyx lobes. Leaf size, flower size and style length are all variable, but relatively few specimens are found with the smaller dimensions given in the above description. Some specimens occur in which either the leaf scales or the calyx lobes are atypical. That is to say, the calyx may be relatively short or the under surface of the leaf may bear a closer covering of scales, but these always allow the epidermis to be visible. The scales may also lack the darker centre. As a result some specimens resemble the geographically adjacent *R. yungningense*.

NATURAL HYBRIDS. *R. impeditum* x *R. nivale* subsp. *boreale* [Forrest 16289, p.p.—BM, E; 17129—E; Rock 16536—A, E, NY, US; Ward 5148 p.p.—E; 5199—E; Yü 5752—A; 14444 p.p.—A]; *R. impeditum* x *R. orthocladum* [Forrest 21274—E]; *R. impeditum* x *R. rupicola* var. *muliense* [Rock 18187—A, NY]; *R. impeditum* x *R. rupicola* var. *rupicola* [Yü 13652—A]; *R. impeditum*, but sufficiently atypical to suggest that it is a hybrid; Ward 4456—E.

16. *R. polycladum* Franchet in Bull. Soc. bot. Fr. 33:234 (1886).

Syn.: *R. scintillans* Balf. f. & W. W. Smith in Notes R.B.G. Edinb. 9:271 (1916).

R. compactum Hutch. in Gard. Chron. 91:326 (1932).

Type. Yunnan, pâturages et rochers au col Koua-la-po (Hoking), 3000 m, 26 v 1884, Delavay 267 bis (holo. P; iso. A, E).

An erect shrub with narrowly elliptic or elliptic leaves about 8–18 mm long. Under side of leaves greyish with brown speckling or more uniformly rust or copper. Calyx lobes obsolete to 2.5 mm long, lepidote at the base, margins ciliate and/or bearing some scales.

An erect shrub up to about 120 cm. Branches of the current year usually covered with rusty brown stalked scales. Leaves usually dispersed along the shoots, petiole 0.5–3.0 mm long, rusty lepidote, blade (4–)8–18(–20) × (2–)3–6(–8) mm, narrowly elliptic to elliptic (fig. 3p), acute or obtuse, very shortly or obscurely mucronate, base cuneate, margin sub-revolute, mid-rib channelled above, usually raised below, upper surface grey-green bearing usually contiguous pale shining scales, under surface greyish with brown stippling, or more uniformly rust or copper, the scales usually discontinuous, or in groups, more rarely closely contiguous, often appearing to vary in size, usually with dark brown centres and tan to paler periphery, or occasionally the two parts of the scale more uniformly fulvous. Inflorescence up to 5-flowered; pedicel 0.5–3.0 mm, lepidote. Calyx obsolete to 2.5 mm long, lepidote at the base and rarely on the lobes, lobes sometimes unequal, deltoid to rounded, margins ciliate and/or bearing some scales, (fig. 2K). Corolla lavender to rich purple-blue, rarely white, broadly funnel-shaped, pubescent

in the throat and occasionally on the outside, elepidote, tube 2.5–5 mm long, lobes 5–8 mm long, stamens 10(–9), 6.5–13.5 mm long, filament hairy in its lower part. *Ovary* 2–3 mm long, covered with pale and/or fulvous scales, with a narrow basal pubescent band. *Style* 10.5–16.0 mm, longer than the stamens, glabrous or rarely with a few hairs at the base. *Stigma* discoid. *Capsule* oblong, up to 6 mm, lepidote, with a persistent calyx.

YUNNAN: on the Mekong-Yangtze divide from 27°30' N, south-eastwards to the Sung Kwei Pass (26°18' N, 100°12' E) (fig. 8).

Delavay 737 p.p. (A, P); *Forrest* 10014; 10015; co-types of *R. scintillans* (A, BM, E, K); 13899 (E); 15033 (E); 15410 (E); 18648 (E); 19447 (E); 19450 (E); 19456 (E); 21483 (BM, E); 21487 (E); 21528 (BM, E); 21559 (BM, E); 22299 (E); 22969 (E); 23024 (E); 23108 (E); 23138 (E); 23139 (E); 23141 (E); 23145 (E); 23147 (E); 23153 (BM, E); 23154 (E); 23340 (E); 23345 p.p. (E); 23361 (BM, E); 23365 (BM, E); 23368 p.p. (E); 25498 (E); 25555 (BM, E); 25904 (E); 25912 (E); 25930 (E); *Headfort* 328 (type of *R. compactum*—K); *McLaren* D265 (BM, E, K); *Rock* 8944 (A, US); 9563 (A, NY, US); 11319 (A, K, US).

First collected near Hoking in 1884 by Delavay. The type sheet in Paris indicates that the numbers *Delavay* 267 bis and 737 became mixed, and are mounted together. *R. fastigiatum* was also mixed with *R. polycladum* and is labelled as *Delavay* 267.

George Forrest collected it in 1913 also at Hoking (nos. 10014, 10015), and introduced it to cultivation in the same year (Dict. of Gardening, ed. Chittenden, 1951). It is now in general cultivation. A form that was awarded a First Class Certificate by the Royal Horticultural Society in 1934 is especially popular. The well-known name *R. scintillans* Balf. f. & W. W. Smith, is based on Forrest's collection from the Hoking area and, since it was published much later than Franchet's name, it must be relegated to synonymy. The Forrest number 10035 was also included in the original description of *R. scintillans*, but it is made up of a mixture of *R. yungningense* and *R. impeditum*. *R. compactum* Hutch. was described from cultivated material raised from seed numbered *Forrest* 13905. Since this number is the type of *R. dasypetalum*, some transference of numbers must have occurred.

R. polycladum occurs on the margins of oak and conifer forests, on open alpine slopes, either dry stony or marshy, and on cliffs. It ranges in altitude between 3000–4300 m.

NATURAL HYBRIDS. *R. polycladum* x *R. nivale* subsp. *australe* [*Forrest* 23362 p.p.—E]. *Forrest* 29290—E and *Goodspeed* 32/2349—E appear to be hybrids between *R. polycladum* and other undetermined species.

17. *R. orthocladum* Balf. f. & Forrest in Notes R.B.G. Edinb. 11:104 (1919).

var. *orthocladum*

Type. Yunnan, mountains in the NE of the Yangtze bend, 3350–3650 m, vii 1913, *Forrest* 10481 (holo. E; iso. A, K).

Low much branched shrub with narrow leaves about 10–15 mm long. Under side of leaves fulvous to fawn, usually with deeper fulvous speckling. Inflorescence usually 2–4 flowered, pedicel short. Calyx lobes small (to 1.5 mm) with a few scales on the back and margin and sparsely ciliate. Style shorter than, or equal to the stamens.

Shrub up to 1.3 m, erect, much branched. Branches of the current year

covered in brown or fulvous scales. *Leaves* usually dispersed along the shoots, petiole 0.8–2.5(–3.0) mm long, densely fulvous lepidote, blade 8.0–16.0 × 2.5–5(–6.0) mm, narrowly elliptic to lanceolate (fig. 3q), apex obtuse, shortly or obscurely mucronate, base cuneate, margin sub-revolute, mid-rib channelled above, raised below, upper surface grey green covered with pale translucent scales, under surface fulvous to fawn usually with deeper fulvous speckling, scales contiguous to a little discontinuous, golden to fulvous with few to many deeper fulvous or tan scales intermixed. *Inflorescence* (1–)2–4(–5)-flowered; pedicel 1.5–2.0(–3.0) mm long, pale to fulvous lepidote. *Calyx* 0.5–1.5 mm long, lepidote at base, lobes rounded to deltoid often unequal, sometimes with a few scales on the back, margin occasionally with a few scales and long cilia (fig. 2L). *Corolla* pale to deep lavender-blue to purple or whitish pink, funnel-shaped; tube 2.0–4.5 mm long, pubescent in the throat; lobes 5–9 mm long, elepidote or rarely sparsely lepidote. *Stamens* 8–10(–11), shorter than the corolla, or rarely equal, 5.5–8.5(–11) mm long, filament hairy near the base. *Ovary* 1.8–2.5 mm long, with a narrow basal pubescent band, otherwise pale lepidote. *Style* 3.5–5.0 mm long, shorter than or equal to the stamens, glabrous or rarely sparsely lepidote, often red or purple. *Stigma* truncate, capsule ovoid 5 mm long, lepidote; calyx persistent.

YUNNAN, SZECHUAN: known from an area including Likiang, Yungning and Muli (fig. 8).

Forrest 11450 (E); 15451 (E); 15640 (E); 16287 (BM, E); 16999 (E); 17107 (E); 20488 (E); 20493 (BM, E); 20627 (E); 20651 (E); 21241 (E); 21288 (E); *Goodspeed* 32/1393 (E); *Rock* 5124 (A, E, K, US); 5126 (A, E, K, US); 17214 (A, E, NY); *Ward* 5065 p.p. (E).

First collected in 1913 by Forrest north-east of the Yangtze loop and repeatedly by him in later years in neighbouring areas. It was introduced to cultivation in 1913 by George Forrest (Dict. of Gardening, ed. Chittenden, 1951; Gard. Chron. 77:315, 1925) and is still represented in gardens (e.g. *Forrest* 16287, 20488, 20493). It occurs between 2500 and 4500 m, growing either on the margins of pine forests or forming thickets on open mountain-sides and summits and on cliffs. The foliage is aromatic. The intensity of colour of the under leaf varies from buff with a few rufous scales to a preponderance of deep rufous scales. In one specimen (*Forrest* 20493), about half the stamens are very short and imperfect. The species is a distinctive one, but in *Forrest* 20488 the style is longer than usual and the leaf scaling is not typical.

var. *longistylum* Philipson & Philipson, var. nov.

A *R. orthoclado* var. *orthoclado* distinctum stylo longiore (15–16 mm longo) foliisque plerumque longioribus (ad 16 mm longa) squamisque subter saepe aequalius atro-rufis.

Type. Yunnan, NW, mount Ta-Pao-Shan, between Wei-Hsi and the Mekong, vii 1928, *Rock* 17135 (holo. NY; iso. A, E).

Distinguished from *R. orthocladum* var. *orthocladum* by the longer style (15–16 mm long) and by the usually longer leaves (to 16 mm long) often with more uniformly deep rufous scales below.

YUNNAN: occupies an area between the Mekong and Yangtze Rivers to the west and south-west of Likiang.

Ching 21609 (A); *Forrest* 21988 (E); *Rock* 18460 (E).

Occurs at about 3500 m in thickets on alpine slopes.

var. *microleucum* (Hutch.) Philipson & Philipson, *comb. et stat. nov.*

Syn.: *R. microleucum* Hutch. in Gard. Chron. 93:334 (1933).

Type. A cultivated specimen grown at Exbury House, near Southampton, England, x 1930 (holo. K; iso. E).

Distinguished from *R. orthocladum* var. *orthocladum* by the white corolla. Not known in nature.

Described from a plant raised by Mr Lionel de Rothschild at Exbury in 1933 from seed collected by Forrest of uncertain provenance. (See Bot. Mag. N.S. t.171A, 1951). This variety is distinguished from var. *orthocladum* by the white flowers. The variety is well established as a garden plant, but specimens with white flowers have not been collected in the wild.

NATURAL HYBRIDS. *R. orthocladum* x *R. impeditum* [Forrest 21274—E]; *R. orthocladum* x *R. hippophaeoides* [Rock 8974—A, E, US].

18. *R. minyaense* Philipson & Philipson, *sp. nov.*

Syn.: "*R. fastigiatum* Franchet" Hemsley & Wilson, p.p., Kew Bull. 117 (1910); Rehder & Wilson in Sargent, *Plantae Wilsonianae* 1:507 (1913).

Type. Szechuan, SW, Djesi-La and Djesi-Longba, south of Tatsienlu, 4600 m, vi 1929, Rock 17726 (holo. E; iso. A, US).

Frutex humilis ramosissimus foliis ovatis vel oblongo-ellipticis, 9–17 mm longis, infra squamis contiguis aureis dense obtectis, squamarum peripheria translucida nonnullarum centro obscuriore. Fasciculus tribus circa floribus, caeruleis ad purpureos, calycis lobi magni (4–7.5 mm longi), membranacei, colorati, plus minusve lepidoti, fimbriati.

Much branched low shrub with ovate or oblong-elliptic leaves, about 9–17 mm long. Under surface of the leaf densely covered with contiguous golden scales with the periphery translucent and in some the centre darker. Inflorescence with about three blue to purple flowers; calyx lobes large (4–7.5 mm long), membranous, coloured, more or less lepidote, fringed.

Shrub up to 60 cm, erect, rounded, much branched. Branches of the current year short, covered in dark brown scales. Leaves clustered at the ends of stunted shoots, petiole 1–3 mm long, densely lepidote, blade (7–)9–17 × (4–)5–10 mm, broadly ovate or oblong-elliptic (fig. 3r), apex obtuse or rounded, mucro obscure, base broadly cuneate, truncate or sub-cordate, margin sub-revolute, mid-rib indistinct or slightly channelled above, slightly raised below, upper surface dull dark green with contiguous to discontinuous translucent pale scales, under surface tawny with some darker speckling, densely covered with contiguous golden scales, periphery translucent, some centres darker. Inflorescence 2–3-flowered; pedicel 1–2 mm long, pale lepidote. Calyx lobes broadly rounded or ovate, membranous, occasionally irregularly lobed, coloured, 4–7.5 × 3–4.5 mm, margin ciliate, sometimes with a few scales, a narrow or broader band of pale scales up the centre, (fig. 1B.) Corolla pale to deep blue or purplish blue, funnel-shaped, tube 4–6 mm long, pubescent in the throat and often on the outside, lobes 10–12 mm long, rarely sparsely lepidote outside. Stamens 10, rarely fewer, slightly shorter than the corolla, 11–15 mm long, filaments hairy near the base. Ovary 2–2.5

mm long, with a narrow basal pubescent band, otherwise pale lepidote. *Style* 14–16 mm long, exceeding the stamens, pubescent or glabrous, reddish purple. *Stigma* discoid. *Capsule* ovoid, 5 mm long, lepidote; calyx persistent.

SZECUHAN: known only from a limited area in the Minya Konka Range, south of Tatsienlu (fig. 8) (the locality given by Wilson is "around Tachienlu").

Rock 17518 (A, E, NY, US); 17534 (E); 17722 (A, E, NY); 17731 (E, NY, US); *Stevens* 352 (F); *Wilson* 3936 (A, BM, K).

This very local species has been collected rarely and is not known in cultivation. It was discovered by Wilson in 1904, but identified, together with a specimen of *R. capitatum*, as *R. fastigiatum* Franchet. Field information is inadequate, but it is evidently a handsome sturdy shrub with dense branching and a profusion of flowers displayed on the surface of the bush. Flower colour is variable. The large coloured calyx indicates relationship with the neighbouring species *R. websterianum* and *R. nitidulum*. From the former this species can be distinguished by the scales of the under side of the leaf being darker and more variable in colour; by the presence of a mucro, and by the young growth appearing after flowering. *R. minyaense* is a larger sturdier plant than *R. nitidulum*, which has smaller leaves and calyx lobes. The gatherings of this species are uniform in facies although particular characters vary in their expression. For example, a few scales may occur on the outside of the corolla lobes (*Wilson* 3936). However, one gathering, *Rock* 17722, departs from the others in several respects: the inflorescences appear to be 1-flowered; on the under side of the leaf the scales are uniform with pale periphery and darker centres and the mid-rib is obscure; the mucro is absent or very obscure; and the calyx lobes are comparatively short (3 mm).

19. *R. bulu* Hutch. in Rhod. Soc. Notes 1929, 31 (ii) No. 5, p. 280 (1932).

Type. Tibet, SE, Lusha, 3050 m, 19 v 1924, *Ward* 5686 (holo. E).

Small shrub with elliptic or oblong leaves 12–21 mm long. Under side of leaves buff usually with tan speckling. Inflorescence few-flowered, pedicel short. Calyx lobes small (usually 1–2 mm), lepidote, margin with scales and often also ciliate.

Shrub, erect and tufted or straggling, up to 1.6 m high. *Branches* of the current year light brown, lepidote. *Leaves* dispersed along the shoots, petiole 1–3(–4) mm long, densely lepidote, blade (8–)12–21 × 4–7(–8) mm, elliptic or oblong-elliptic (fig. 3s), apex rounded, obscurely mucronate, usually emarginate, base broadly cuneate, margin sub-revolute, mid-rib prominent below, channelled above, other veins obscure, upper surface dull green with impressed discontinuous or contiguous scales with colourless shining margins and amber centres, under surface pale with tan speckling, epidermis pale green with contiguous (often in groups) or slightly discontinuous colourless, straw or buff scales usually with some often larger tan scales dispersed among them. *Inflorescence* 1–3(–5)-flowered; pedicel pubescent and with pale and amber scales, 1–2 mm long. *Calyx lobes* triangular to irregularly rounded, 1–2(–4) mm long, outer surface lepidote with pale (or some amber) scales, margin with mostly amber scales and often with few to many long cilia (fig. 2O). *Corolla* pinkish-purple, magenta, deep violet or occasionally white, pubescent in the throat and rarely on the outer surface, tube 2.5–3(–5) mm, lobes

(7-)8-10(-12) mm, with pale scales on the outer surface. *Stamens* (8-)10, (9.5-)10-14(-15) mm long, filament hairy near base, usually coloured similarly to the corolla. *Ovary* (1.5-)2-2.5 mm long, with a narrow basal pubescent band, pale lepidote above. *Style* 12-17 mm long, usually exceeding the stamens, usually pubescent and often with some scales. *Stigma* discoid. *Capsule* ovoid, about 5 mm long, lepidote; calyx persistent.

SE TIBET: valley of the Tsangpo between 93° and 95° E (fig. 7).

Ludlow & Sherriff 2622 (BM, E); Ludlow, Sherriff & Elliot 12397 (A, BM, E, UPS); 12397A (BM); 13316 (BM, E); 13520 (BM, E); 15729 (BM); Ludlow, Sherriff & Taylor 4277 (BM, E); 4440 (BM, E); 4496 (BM, E); 4996 (BM, E); 5664 (BM, E); 6213 (BM, E); Ward 5644 (BM, E, K); 5714 (K).

R. bulu is known from a restricted area in the Tsangpo valley, where it was first collected by Kingdon Ward in 1924. It is not known in cultivation. Its altitudinal range is evidently limited, since it has been recorded only between 3000-3800 m where it occurs in open woodland of *Pinus*, *Abies*, *Quercus* and *Betula*, as well as on open scrubby and rocky hillsides. Although originally described from a shrub with white flowers (Ward 5686), the collector's field notes show that he regarded this as a white form of a locally abundant shrub with bright purple flowers. The species is rather constant in its characters though the depth of colour in the leaf-scales may vary in the same population, giving a fawn rather than a flaxen appearance to the under sides of the leaves. Perhaps the most variable feature observed concerns the pubescence and scaling of the style. In the same gathering, individuals show glabrous or pubescent styles, with or without few to several scales.

NATURAL HYBRID. *R. bulu* x *R. nivale* subsp. *nivale* [Ward 5735-K].

20. *R. telmateium* Balf. f. & W. W. Smith in Notes R.B.G. Edinb. 9:279 (1916).

Syn.: *R. diacritum* Balf. f. & W. W. Smith, l.c. 225.

R. drumonium Balf. f. & W. W. Smith, l.c. 226.

R. idoneum Balf. f. & W. W. Smith, l.c. 237.

R. pycnocladum Balf. f. & W. W. Smith, l.c. 267.

Type. Yunnan, mountains of the Chungtien plateau, 3650 m, vi 1914, Forrest 12568 (holo. E).

A much branched low shrub with lanceolate, elliptic or rotund leaves, about 3-12 mm long, distinctly mucronate. Under surface of the leaf pale gold or rufous with darker speckling (rarely absent). Inflorescence usually 1-2-flowered. Calyx small (0.5-2.5 mm, rarely larger), lepidote, with margins bearing scales and/or long cilia. Corolla lepidote.

A much branched prostrate shrub forming dense cushions or mats or erect up to 1 m high. Branches of the current year densely covered in brown scales. Leaves dispersed along the branchlets, or crowded at the ends, petiole 0.3-3.0 mm long, densely lepidote, blade 3-12(-14) × 1.5-5(-6.5) mm, narrowly elliptic or lanceolate to broadly elliptic or rotund (fig. 3t), apex acute to rounded, strongly mucronate, base cuneate, margin flat to sub-revolute, mid-rib slightly grooved above or not, slightly raised below, upper surface dull grey-green covered in pale gold scales, under surface golden-fawn to pale orange or rufous with amber to dark tan or brown speckling, the

densely overlapping scales bicolorous, or rarely uniform, the majority pale gold to rufous mixed with few to many darker scales, or these rarely absent. *Inflorescence* 1-2(-3)-flowered; pedicel 0.5-1.5(-2) mm long, lepidote, sometimes also puberulous. *Calyx* 0.5-2.5(-3) mm long, deltoid to rounded, often unequal, pale lepidote, margin with scales and/or long cilia (fig. 2c). *Corolla* lavender or rose-pink to purple, broadly funnel-shaped, pubescent in the throat and often on the outside, tube 2-4 mm long, lobes (4-)5-8(-10) mm long, sparingly to densely pale lepidote outside, stamens 10 (8-11), pubescent in their lower part, variable in length, ranging from 3-6 mm in small flowers to 9-13 mm in large flowers, but more or less reaching the corolla mouth, corolla also varying greatly in size. *Ovary* 1.5-2.5(-3) mm long, pale lepidote with a narrow basal pubescent band. *Style* 3-17 mm long, shorter than, longer than, or equal to the stamens, glabrous or pubescent towards the base, sometimes with a few scales. *Stigma* truncate or discoid. *Capsule* ovoid, about 3 mm long, lepidote; calyx persistent.

YUNNAN, SZECHUAN: extending from the Bei-ma-shan to the Chungtien Plateau and the Kulu Mountains southwards past the Likiang Range and the Chienchuan-Mekong divide to near Tali (fig. 8). The locality given on the label of *Forrest* 18652 is Tsarong, southeast Tibet, which is outside the range of all other collections of this species. The field data also state that the specimen is a duplicate of a collection made in 1917, but we have seen no collection of this species made in 1917 from Tsarong. It seems probable, therefore, that *Forrest* 18652 is incorrectly localized.

Ching 20328 (A); 30233 (A); *Delavay* 360 p.p. (BM, E); 4333 p.p. (E, P); *Feng* 1141 (A); 1456 (A); *Forrest* 2181 (E); 5534 (A, E, US); 5879 (BM, E); 10070 (A, E, two sheets of BM also with *R. impeditum*); 10424 (A, BM, E); 10434 (A, BM, E); 11010 (E); 11497 (A); 12478 (E); 12614 (E); 12623 (E); 13768 (BM, E); 13847 (E); 15085 (BM, E); 15094 (E); 15120 (E); 15132 (BM, E); 15154 (E); 15210 (BM, E); 15255 (E); 15256 (E); 15268 (E); 15370 (E); 15372 (E); 15386 (E); 15407 (E); 15467 (E); 15468 (E); 15639 (E); 15643 (E); 15645 (E); 15958 (E); 15972 (E); 16257 (E); 16288 (BM, E); 16296 (BM, E); 16300 (E); 16313 (E); 16977 (E); 16981 (E); 16985 (E); 17126 (E); 17127 (E); 18652 (E); 20453 (BM, E); 20457 (BM, E, K); 20461 (E); 20477 (BM, E); 20512 (E); 20553 (E); 20638 (E); 20949 (E); 21046 (BM, E); 21239 (E); 21247 (BM, E); 21250 (BM, E); 21276 (E); 21289 (E); 21377 (BM, E); 21424 (BM, E); 21436 (E); 21577 (E); 21922 (E); 21932 (E); 23360 (E); 28344 (E); 29269 (E); 29338 (E); 30938 (E); *Goodspeed* 32/1399, (E); *McLaren* P51 (BM, E); P74 (BM, E); *Handel-Mazzetti* 7544 (E); *Rock* 3360 (E); 3431 (E); 3575 (E, US); 3818 (A, E, US); 3939 (A, E, US); 4080 (E, US); 4118 (E, US); 4256 (E); 5201 (E, K, US); 5220 (E, K, US); 5490 (E, K, US); 5534 (A, US); 5593 (A, K, US); 5597 (A, E, K, US); 7995 (E); 8507 (E); 9034 (E, US); 10553 (E, US); 11465 (E); 16004 (E, US); 16006 (BM, E, US); 16081 (E, US); 16148 (E, US); 16207 p.p. (E); 16228 (E, US); 16467 (E, NY, US); 17840 (A, E, NY); 17995 (NY); 23712 (A, BM, E, NY, US); 23772 (BM, E, F, NY, US); 23790 (BM, E, F, NY, US); 24319 (A, BM, E, K, NY, US); 24336 (BM, E, NY); 24361 (BM, E, K, NY, US); 24740 (A, BM, E, F, NY, US); 24858 (A, BM, E, NY, US); 24975 (A, BM, E, F, NY, US); *Wang* 70807 (A); 71025 (A); *Ward* 269A (E); 4102 (E); 4268 (E); 4733 (E); 5065 p.p. (E); 5151 (E); 5179 (E); 5188 (E); 5198 (E); 5218 (E); *Yu* 6190 (A); 6465 (A); 7083 (A); 15155 (A, BM, E).

This species was first collected in the Tsang-chan mountains, above Tali in 1883, by Delavay, mixed with his no. 360, which is the type of *R. fastigiatum*. It was next collected in 1906 by Forrest from dry ledges and clefts of limestone cliffs on the eastern flank of the Likiang Range (*Forrest* 2181), where he again collected it four years later (*Forrest* 5879). These two gatherings were described as *R. pycnocladum* by Bayley Balfour & W. Wright Smith in the 1916 volume of *Notes R.B.G. Edinb.* In the same publication these

authors described four other species. The additional material now available clearly indicates that all these five species are conspecific. The characters by which they were distinguished are therefore discussed below.

1. *R. idoneum*, based on a specimen collected in 1914 by Forrest from open situations on the Chungtien Plateau (Forrest 12623). Distinguished by the uniform colour of the under side of the leaf as opposed to punctulate leaves in the other four species. Material now available shows that the frequency of darker scales in relation to the paler background scales varies widely, and that occasional individual plants occur without any darker scales, though in other respects they conform to the characters of the species. We consider that the type specimen of *R. idoneum* is such a sporadic variant. Its leaves very closely resemble those of the neighbouring *R. diacritum*, which itself has only very few darker scales on its leaves.

2. *R. pycnocladum*, based on Forrest 2181 and 5879, distinguished by its denser habit, due to the short-twigged growth, which was considered to be distinct from that of *R. telmateium*, *R. drumonium* and *R. diacritum*. The many collections of this complex now available show it to vary considerably in stature and form of branching. There seems to be no justification for selecting one of these many forms for specific recognition.

3. *R. drumonium*, based on a specimen collected in 1913 by Kingdon Ward (Ward 296A) in open pine forest in the valley of the Chung river. Distinguished by the short style in contrast to the style longer than the stamens in *R. telmateium* and *R. diacritum*. Since measurements of styles of all available collections show a continuous variation from 3–17 mm in style length, there is no justification for segregating taxa on the basis of style length.

4. *R. diacritum*, based on a specimen collected in 1914 by Forrest from open situations on the Chungtien Plateau (Forrest 12614), distinguished by its broad leaves from the lanceolate leaves of *R. telmateium*. Leaf shape and size vary very widely within this complex, but no correlation of these characters with any other, or with geographical distribution, is apparent. Consequently sub-division of taxa on the basis of leaf shape is now seen to be artificial.

5. *R. telmateium*, based on two specimens collected in 1914 by Forrest from pine forests in the mountains west of Fengkow (Forrest 12478) and from open boggy situations on the margins of forests on the Chungtien Plateau (Forrest 12568). It was distinguished by its narrow punctulate leaves, long style, and open habit.

For the reasons set out above, we unite these five species, and select the name *R. telmateium* from those available and designate Forrest 12568 as the type of the species. The whole complex has been repeatedly collected from many localities and exhibits variation in habit, leaf size and shape, scale colouring and proportion of darker scales, style length and flower size. In spite of this polymorphism it represents an entity well defined morphologically and geographically. The combination of a small calyx with a mucronate and punctulate leaf—that is, a leaf with an irregular scattering of darker scales over a paler background—defines this species, even though individual plants may have more or fewer darker scales than are generally present.

R. telmateium ranges from 2900–5000 m, and occurs in oak and pine forests and on open rocky slopes, limestone cliffs and alpine grasslands, as a low carpet or as separate rounded shrubs.

R. telmateium is an uncommon plant in cultivation. We have found no published account of its introduction to cultivation, but the following numbers are growing at Savill Gardens, Windsor: *Forrest* 16257 (1917-19), 20477, 21250, 21377 (1921-22); *Ward* 4102 (1921).

NATURAL HYBRIDS. *R. telmateium* x *R. intricatum* [*Ward* 5158—E], *R. telmateium* x *R. thymifolium* [*Rock* 17489—A, E, NY, US].

21. *R. nivale* Hook. f., Rhododendrons of Sikkim Himalaya 29 (1849).

subsp. *nivale*

Syn.: *R. paludosum* Hutch. & Ward in Notes R.B.G. Edinb. 16:175 (1931).

(See also Stevenson, *The Species of Rhododendron* p. 418, 1930).

Type. Sikkim/Tibetan frontier, 4800-5490 m, *Hooker* s.n. (holo. K; iso. E, UPS, US).

A low shrub with elliptic to rotund leaves about 4-9 mm long. The under side of the leaves fawn with dark brown speckling. Inflorescence usually 1-2-flowered. Calyx lobes strap-shaped, reddish-purple, with some scales on the outer surface and a band of dark scales on the margin, often with some cilia intermingled.

A low compact much-branched shrub, prostrate or rising to 60-90 cm or rarely to 120 cm. Branches of the current year covered with dark scales. Leaves usually congested at the ends of the shoots or sometimes dispersed along them, petiole 0.5-2.0(-3.0) mm long, lepidote, blade 3.8-9(-12) x (1.5-2-5(-6) mm, elliptic to broadly elliptic (fig. 3u¹), ovate or rotund, apex obtuse or rounded, emucronate or very rarely shortly mucronulate, base broadly cuneate, margin subrevolute, mid-rib slightly channelled above, slightly raised below, upper surface dark grey-green speckled with whitish or golden scales, under surface yellowish to warm fawn with dark brown speckling, the scales contiguous with some leaf-surface visible to slightly discontinuous, bicolorous, the majority pale gold, with dark scales widely but regularly spaced, rarely the two colours more or less equal in number. Inflorescence 1- or 2-, rarely 3-flowered; pedicels 0.5 rarely up to 1.5 mm long, lepidote and sometimes also pubescent. Calyx 2.0-4.0(-4.5) mm long, oblong or elongate-deltoid, lepidote, and sometimes pubescent at the base, lobes coloured, bearing pale and some dark scales on their outer surface, margin lepidote, usually with a continuous band of dark scales, and often with some cilia (fig. 2P-R). Corolla variable in colour, ranging from rich purple, through magenta and lilac to pink, broadly funnel-shaped, pubescent in the throat, and also often on the outside of the corolla, lepidote or occasionally lepidote (these characters may be variable within a population), tube (2.5-)3-4(-6) mm long, lobes (4.5-)6-9(-10) mm long. Stamens usually 10, or 8-11 with or without additional imperfect stamens (rarely plants with 5-7 stamens occur), pubescent on their lower part, either longer or shorter than the corolla, varying from 4.3-13.5 mm in length. Ovary 1.5-2.0 mm long, covered with pale scales except for a narrow basal pubescent band, style variable in length, usually longer than the stamens, rarely shorter, 3.5-18 mm, either glabrous or slightly pubescent at the base. Stigma discoid. Capsule rotund to ovoid, 3-5 mm long, lepidote; calyx persistent.

NEPAL, SIKKIM, BHUTAN, TIBET: extending along the Himalaya from West

Nepal (83°22' E) to their eastern limit, and also in south-east Tibet from the neighbourhood of Mt Everest to north of Lhasa and eastwards to the Ata Kang La (Zayul) (97°24' E) [fig. 7].

Aufschneider 14800 (BM); *Bor & Ram* 20484 (E, K); 20801 (E); *Bowes-Lyon* 2098 (BM); *Chapman* 70 (K); 109 (K); 159 (K); *Cooper* 3483 (E); 3838 (E); *Gould* 2250 (K); *Hanbury-Tracy* 167 (BM); *Ludlow & Sherriff* 1598 (BM, E); 1779 (BM, E); 1788 (BM, E); 2300 (BM, E); 5950 (E); 8653 (A, BM, E); 8824 (A, BM, E); 9537 (A, BM, E); 9575 (BM, E); 9979 (BM, E); *Ludlow, Sherriff & Elliot* 11610 (E); 11804 (E); 12120 (E); 13125 (A, BM, E); 13701 (A, E); 13872 (BM, E); 15058 (A, BM, E, UPS); 15208 (BM, E, UPS); 15650 (BM, E); 15668 (BM); *Ludlow, Sherriff & Hicks* 16294 (BM, E); 18960 (BM, E); *Ludlow, Sherriff & Taylor* 3805 (BM); 3830 (BM); 3999 (BM); 4253 (BM); 4784 (BM); 4826 (BM); 5283 (BM); *McCosh* 362 (BM); *Morton* 16 (K); 197 (K); *Polunin* 352 (E); *Polunin, Sykes & Williams* 4 (UPS); 28 (BM, E, UPS); 1141 (BM, UPS); 2205 (BM, E, UPS); *Richardson* 59 (BM); *Shristha* 5401 (BM); *Stainton* 4387 (BM, E); 4728 (BM); *Wager* 205 (K); *Walsh* 135 (BM, K); *Ward* 5667 (K); 5729 (E, K); 5777 (E); 5778 (K); 5779 (K); 5780 (K); 5792 (type of *R. paludosum*—E, K); 5862 (K); 5922 (K); 5950 (K); 7001 (K); 7058 (K); 10521 p.p. (A, BM); 10595 (BM); 10716 p.p. (BM); 11016 (BM); 11610 (BM); 11676 (BM, E); 11804 (BM); 12120 (BM); 13701 (BM); 19606 (BM); *Younghusband* s.n. (K); *Zimmermann* 523 (BM); 538 (BM, E).

First collected in 1849 by Hooker in Sikkim. It is rare in cultivation, and we have found no published information about its introduction. A plant at the Royal Botanic Garden, Edinburgh, was introduced by R. E. Cooper, in (about) 1915, and plants raised from seed introduced by Kingdon Ward are growing at the Savill Gardens, Windsor [*Ward* 5729, 5777 (1924), 7058 (1926)]. It is a difficult plant to maintain, and it is not in general cultivation. It grows, usually gregariously, on open mountainsides from the treeline up to scree and bare ridges. Spencer Chapman records it reaching an altitude of 19000 ft (5800 m) and Hooker was greatly impressed by its hardiness. He states "The hard woody branches of this curious little species, as thick as a goose quill, straggle along the ground for a foot or two, presenting brown tufts of vegetation where not half a dozen other plants can exist. The branches are densely interwoven, very harsh and woody, wholly depressed; whence the shrub, spreading horizontally, and barely raised two inches above the soil, becomes eminently typical of the arid stern climate it inhabits. The latest to bloom and earliest to mature its seeds, by far the smallest in foliage, and proportionally largest in flower, most lepidote in vestiture, humble in stature, rigid in texture, deformed in habit, yet the most odoriferous, it may be recognized, even in the herbarium, as the production of the loftiest elevation on the surface of the globe—of the most excessive climate—of the joint influences of a scorching sun by day, and the keenest frost at night—of the greatest drought followed in a few hours by a saturated atmosphere—of the balmy calm alternating with the whirlwind of the Alps. For eight months of the year it is buried under many feet of snow: for the remaining four it is frequently snowed and sunned in the same hour. During genial weather, when the sun heats the soil to 150°, its perfumed foliage scents the air; whilst to snow-storm and frost it is insensible, blooming through all, expanding its little purple flowers to the day, and only closing them to wither after fertilization has taken place".

R. nivale subsp. *nivale* is rather uniform in character. In moist locations its branches may lose their interwoven character and reach a height of 120 cm. In some of the more easterly specimens the leaf apex is slightly mucronate, though this character occurs rarely even at the western end of the range of

the species. Smaller calyx lobes are very rare (e.g. *Ward* 11676; 27°40' N, 92°13' E). Hutchinson & Ward did not compare their *R. paludosum* with *R. nivale* but with *R. alpicola* Rehder & Wilson, and both these species are keyed out from *R. nivale* by Hutchinson (in Stevenson, 1930) by their pubescent styles. However, pubescence occurs quite commonly on the styles of *R. nivale*, and there is no doubt that *R. paludosum* and *R. nivale* are conspecific. (*R. alpicola*, with a smaller calyx, conforms with the subspecies *boreale*).

NATURAL HYBRID. *R. nivale* subsp. *nivale* x *R. bulu* [*Ward* 5735—K].

subsp. **boreale** Philipson & Philipson, subsp. nov.

Syn.: *R. nigropunctatum* Franchet in Journ. Bot. Paris 5:95 (1891).

R. ramosissimum Franchet, l.c. 12:204 (1898).

R. alpicola Rehder & Wilson in Sargent, Plantae Wilsonianae 1:506 (1913)—var. *strictum* Rehder & Wilson, l.c. (1913).

R. violaceum Rehder & Wilson, l.c.: 513 (1913).

R. oresbium Balf. f. & Ward in Notes R.B.G. Edinb. 9:253 (1916).

R. stictophyllum Balf. f., l.c. 11:139 (1919).

R. vicarium Balf. f., l.c. 12:176 (1920).

R. batangense Balf. f., l.c. 13:31 (1920).

R. oreinum Balf. f., l.c. 13:54 (1920).

R. yaragongense Balf. f., l.c. 13:64 (1920).

A *R. nivale* subsp. *nivale* et subsp. *australe* distinctum calycis lobis semper parvis vel obsoletis styloque plerumque staminibus brevior. *Squamae* in inferiore foliorum pagina typico speciei colore plerumque tinctae, sed pagina inferior magis uniformiter rufa videtur minore discrimine inter duos squamarum colores. *Mucro* brevis etiam nonnumquam ex folii apice oritur (fig. 3u²). Type. Yunnan, mountains of Moting, NE of the Yangtze-Mekong water-shed, vi 1923, *Rock* 9312 (holo. E; iso. K).

Distinguished from *R. nivale* subsp. *nivale* and subsp. *australe* by the consistently small or obsolete calyx lobes, and by the style being predominantly shorter than the stamens. The colouring of the scales on the under side of the leaf is usually that typical of the species, but an appearance of a more uniform rufous colour may be produced by less contrast between the two scale colours. There is also a tendency for the development of a short mucro on the leaf apex.

TIBET, YUNNAN, SZECHUAN: extending from a little east of the limits of *R. nivale* subsp. *nivale* at Dokerla, Moting, Batang and Atuntze eastwards to Chungtien, Yungning and Muli and to Baurong and north of Tatsienlu (fig. 7) *Bonvalot* & *Prince Henri of Orleans* s.n. (type of *R. nigropunctatum*—K, P); *Forrest* 13987 (E); 14018 (E); 14040 (E); 16289 p.p. (BM, E); 16305 (BM, E); 16307 (E); 16500 (E); 16545 (BM, E); 17134 (E); 17294 (E); 19195 (E); 19597 (BM, E); 19676 (E); 20462 (E); 20601 (E); 20715 (E); 20928 (E); 21301 (E); 29251 (E); *McLaren* Z3 (E); *Muir* s.n. 1911 (A, BM); *Mussot* 265, (type of *R. ramosissimum*—BM); *Rock* 8847 (A, E, K, NY); 9268 (E, US); 9311 (A, E, K, US); 9321 (E, US); 9957 (A, E, US); 16207 p.p. (E); 17535 (A, E, NY, US); 17562 (A, E, NY, S, US); 17880 (A, E, NY); 22803 (A, BM, E, F, K, NY, US); 22848 (BM, E, F, K, NY); 23310 (A, BM, E, K, NY); 23316 (A, BM, E, K, NY, US); 23317 (E, K); 23839 (A, BM, E, F, K, NY); 24385 (E, F, K, NY, US); 34395 (BM); *Smith* 12951 (GB); *Soulié* 2772 (type of *R. vicarium*—E, P); 3303 (type of *R. stictophyllum*—E, P); 3304 (type of *R. batangense*—E, P); 3708 (P); 3709 (type of *R. yaragongense*—E, P); 3710 (type of *R. oreinum*—not 3701, as cited in description—P); *Stevens* 239 p.p. (A, BM, F);

Wang 21175 (A, E); 66472 (A); Ward 541 (type of *R. oresbium*—E); 4679 (E); 5196 (E); 11676 (BM, E); Wilson 1319 (BM, E, K, US); 3460 (A, BM, E, US); 3463 (type of *R. violaceum*—A, E, US); 3465 (BM, E, K); 3467 a (BM, E, K, US); 3468 (BM, E, K); 3469 (A, BM, K, US); 4269 (A, BM); Yü 7994 (A, E).

First collected in 1890 between Lhasa and Batang by Bonvalot & Prince Henri d'Orleans, and described by Franchet as *R. nigropunctatum*. This subspecies was subsequently collected near Tatsienlu by Mussot, Soulié and Wilson, each of these collections being described as distinct species by Franchet, Balfour and Rehder & Wilson respectively. Since these three collections were from the extreme eastern end of the range of the species, it is understandable that no connection with the Himalayan *R. nivale* Hook. f. was suspected at that time. Even when Balfour & Ward described one of Kingdon Ward's collections from the Doker La as a new species, they compared it with neither *R. nivale* nor *R. nigropunctatum*, because they considered its leaf-scales to be uniform in colour. Balfour also described four collections made by Soulié near Yaragong as separate species, but again referred to neither *R. nivale* nor *R. nigropunctatum*. The characters used to differentiate between these various synonymous species can now be seen to be individual variations of such features as style-length, colour-contrast of scales, pubescence of the corolla tube or style, and detailed features of the calyx. That five similar species, each represented by one specimen, have been described from the Batang-Yaragong region, and three from near Tatsienlu, suggests that individual variation was being used in species formation. The more abundant material now available confirms this. The large number of names applied to this Chinese plant has been a continual source of confusion, and the variability of the slight differences which were supposed to separate the species has led to inconsistent interpretations of their names.

The subspecific character of a small calyx is virtually constant over a wide geographical area. However, very rarely specimens with larger calyx lobes occur (e.g. Ward 4679).

Because of the confusion of names under which this subspecies has been collected, it cannot be established with certainty when it was first introduced into cultivation. However, a plant introduced by Wilson as *R. nigropunctatum* and grown at Veitch's nurseries was figured when eight years old in the *Botanical Magazine* (t.8529, 1913). It has been re-introduced since, for example Rock 24385 growing at Edinburgh, and a plant still growing in the Savill Gardens, Windsor, was raised from seed collected by Kingdon Ward (no. 5383) during his expedition on the Yunnan-Tibet border in 1922. No herbarium specimen bearing that number has been seen. A plant referred to as *R. violaceum* (in Gard. Chron. 40:224, 1914) was probably *R. impeditum*, since the herbarium specimen of the number referred to (Forrest 5876) is of that species.

R. nivale subsp. *boreale* is a plant of open moorland, occurring both on dry rocky slopes and in swampy grassland, either as a gregarious carpeting shrub or as scattered cushions. Its altitudinal range is 3200–5000 m.

NATURAL HYBRIDS. *R. nivale* subsp. *boreale* x *R. impeditum*: [Forrest 16289 p.p.—E; 17129—E; Rock 16536—A, E, NY, US; Ward 5148 p.p.—E;

5199—E; Yü 5752—A; Yü 14444 p.p.—A]; *R. nivale* subsp. *boreale* x *R. rupicola* var. *rupicola* [Ward 10531—E]; x var. *muliense* [Rock 16477—A, E, NY, US]; *R. nivale* subsp. *boreale* x *R. tapetiforme* [Rock 9266—US; Wang 66464—A].

Rock 22809 (A, BM, E, F, K, NY, US) from south-east of Atuntze is regarded as a hybrid with *R. nivale* subsp. *boreale* as one parent. None of the other species known from this region can be suggested as the other parent. The leaves of the several species seen are uniformly narrowly elliptic, or almost lanceolate, a character rarely seen in Section *Lapponicum* (e.g. *R. polycladum*, *R. orthocladum*). Characters such as the size of the calyx and the presence of scales on the outside of the corolla are very variable in the collection, a situation compatible with its being of hybrid origin.

The type collection of *R. edgarianum* Rehder & Wilson (Wilson 3467 A, E, from north of Tatsienlu) is also interpreted as a hybrid of *R. nivale* subsp. *boreale* with an undetermined second parent. The almost uniformly coloured, rufous scales on the lower surface of the leaves are not typical of *R. nivale* and the large membranous calyx lobes are quite outside the characters of that plant. Wilson 1319, also cited in the original description is typical *R. nivale* subsp. *boreale*. Wilson 3459, also cited in the original description cannot be located in the Arnold Arboretum.

subsp. *australe* Philipson & Philipson, subsp. nov.

A *R. nivali* subsp. *nivali* distinctum calycis lobis plerumque angustioribus loborum marginibus plerumque ciliatis paucis solum squamis ornatis; foliorum apicibus acutioribus; minore discrimine inter duos colores squamarum inferioris foliorum paginae; habitu saepe erectiore.

Type. Yunnan, Chao-ii-Shau, Mekong-Yangtze divide, 4260 m, vii 1924, Forrest 25707 (holo. E).

Distinguished from *R. nivale* subsp. *nivale* by the generally narrower calyx lobes having margins predominantly ciliate with usually only a few scales; by the more acute apex of the leaves (fig. 3u³); by the contrast between the two colours of the scales on the under side of the leaves being less pronounced; and by the often more erect habit.

YUNNAN: occurring south of Chungtien (adjacent to the range of subsp. *boreale*) and in the Likiang Range. Also along the Mekong-Yangtze divide from about 27°20' N, south-eastwards to the Sung Kwei Range (26°18' N, 100°12' E) (fig. 7).

Forrest 21492 (E); 21547 (E); 21972 (E); 21974 (E); 23112 (E); 23140 (E); 23142 (E); 23143 (E); 23146 (E); 23148 (E); 23152 (E); 23345 p.p. (E); 23362 p.p. (E); 23368 p.p. (BM); 23369 (E); 25909 (E); Rock 9492 (A, E); 9494 (E, K, US); 9510 (E, US); 9519 (A, E); 9584 (A, E, NY, US); 11249 (A, E, US); 11304 (E, NY, US); 24645 (A, BM, E, NY); 25081 (A, BM, E, K, NY); 25377 (A, E, NY); Yü 6795 (A); 7050 (A); 12948 (A).

First collected in 1922 by Forrest on the Chienchuan-Mekong divide, and by Rock in the following year. It is a plant of alpine moorland and cliffs, frequently on limestone, occurring between 3100 and 4300 m altitude. Unlike the subspecies to the north this plant has not been described as a species but is identified in herbaria under a variety of specific names (including *R. paludosum* and *R. ramosissimum*, which are synonyms of the species). The

size of the calyx lobes distinguishes this subspecies from that directly to the north, and the more ciliate (rather than lepidote) calyx lobes distinguish it from subsp. *nivale*. The scales of the under side of the leaf are bicolorous, but in place of the contrast between pale and almost black scales which is typical of the species, many specimens of this subspecies have a more rufous background with the darker scales dark tan rather than black. There is no record of this subspecies in cultivation.

NATURAL HYBRID. *R. nivale* subsp. *australe* x *R. polycladum* [Forrest 23362 p.p.—E].

22. *R. burjaticum* Malyshev in Not. Syst. Herb. Inst. Bot. Acad. Sci. URSS 21:455-458 (1961).

Type. USSR, montes Sajanenses orientales, alpes Kitojenses, fl. Saghan-Sajr, 20 vi 1958, *Malyshev* s.n. (holo. LE, non vidi; iso. IRK, non vidi).

A low spreading shrub with elliptical to ovate leaves, 8-12 mm long. Under surface of the leaf densely covered with contiguous pale gold and amber scales. Inflorescences with several rosy-violet flowers on rather long pedicels (to 3.5 mm). Calyx lobes very small (0.5 mm), lepidote, ciliate. Style shorter than the stamens.

Shrub up to 15 cm high, much branched, spreading. *Branches* of the current year rufous-brown lepidote and minutely pubescent. *Leaves* mainly clustered at the ends of shoots, petiole 1-3 mm long, rufous lepidote, blade 8-12 x 3-6 mm, elliptic to ovate (fig. 3v), apex obtuse, mucronate, base broadly cuneate, margin sub-revolute, mid-rib channelled above, raised below, upper surface dull dark green covered with mostly slightly discontinuous pale scales, under surface bicolorous, densely covered with contiguous pale gold scales mixed with darker amber scales. *Inflorescence* 3-8-flowered; pedicel (1)2-3.5 mm long, pale lepidote and minutely pubescent. *Calyx lobes* rounded to triangular, about 0.5 mm, pale lepidote, margin ciliate, (fig. 2D). *Corolla* rosy-violet, narrowly funnel-shaped, tube 5-7 mm long, pubescent in the throat, lobes 7-8 mm long, clepidote. *Stamens* 5-10, usually 7, shorter than the corolla, 7-8 mm long, filaments hairy below. *Ovary* 2.0 mm long, with a narrow basal pubescent band, otherwise pale lepidote. *Style* 3-4 mm long, shorter than the stamens. *Stigma* discoid. *Capsule* ovoid, 6 mm long, lepidote; calyx persistent.

USSR: known only from a limited area to the west of the southern end of Lake Baikal, on the eastern Sajan mountains.

Malyshev 4600 (BM, K).

This recently discovered species is the only member of the Section, besides *R. lapponicum* itself, which occurs outside the Sino-Himalayan region. It occurs where the range of *R. lapponicum* approaches most closely to the Chinese species. This gap in the distribution of the Section is of about 1600 kilometres and spans the Gobi desert. *R. burjaticum* grows in moist places in larch woods near the upper limit of tree growth. It is similar in habit and inflorescence to *R. lapponicum*, but the proportions of the corolla, stamens and style are distinctive.

23. *R. lapponicum* (L.) Wahlenb., Fl. Lapp. 104 (1812).Syn.: *Azalea lapponica* L., Sp. Pl. 151 (1753).*Rhododendron ferrugineum* Georgi, Bemerk. Reis. Russ. Reich. 1:213 (1775)—non Linn.*Azalea ferruginosa* Pallas, Fl. Ross. II: plate 70, fig. 1, A, B (1788).*Rhododendron parvifolium* Adams in Nouv. Mém. Soc. Nat. Mosc. 9:237 (1834).*R. palustre* Turcz. in Bull. Sc. Nat. Mosc. 11:96 (1838).*R. parviflorum* F. Schmidt, Fl. Sachal. 158 (1868).*R. parvifolium* var. *albiflorum* Herder ex Maxim. in Mém. Acad. Imp. Sci. St. Petersb. ser. 7, 16:17 (1870).*R. lapponicum* var. *genuinum* Herder in Acta Hort. Petrop. 1:343 (1872): var. *albiflorum* Herder, l.c.; var. *parvifolium* (Adams) Herder, l.c.*R. parvifolium* f. *alpina* Glehn in Acta Hort. Petrop. 4:66 (1876): f. *elata* Glehn, l.c.*Azalea parvifolia* (Adams) Kuntze, Rev. Gen. 2:387 (1891).*Rhododendron confertifissimum* Nakai in Bot. Mag. Tokyo 31: 239 (1917).

Type. Described from Lapland.

Prostrate or erect shrub with elliptic to oblong leaves varying from 4–25 mm long. Under surface of the leaf densely covered with pale and reddish-brown scales mixed in varying proportions. Inflorescence few-flowered with rather long pedicels (up to 12 mm at anthesis). Calyx lobes deltoid, 1.5–2.0 mm long, lepidote, margin ciliate.

A much branched prostrate or erect shrub up to 1 m tall. Branches of the current year densely covered with reddish-brown scales which darken to black with age, minutely puberulous. Leaves dispersed along the branchlets or crowded at their ends, petiole 1.5–4.0 mm long, lepidote, blade 4–20(–25) × 2–7(–9) mm, oblong-elliptic or elliptic-ovate (fig. 3W), apex obtuse or rounded, mucronate or obscurely mucronate, base cuneate, decurrent on the petiole, margin sub-revolute, mid-rib channelled above, slightly raised below, upper surface dark grey-green, covered in pale scales, under surface fawn to ferruginous, the contiguous scales bicolorous, either straw-coloured to fawn or ferruginous, the two colours occurring in varying proportions. Inflorescence 3–6-flowered, pedicel 3–12 mm long, somewhat longer in fruit, lepidote. Calyx 1–2 mm, lobes deltoid, variably lepidote, margin ciliate sometimes with a few scales (fig. 2E). Corolla violet-rose to purple, or sometimes white, broadly funnel-shaped, pubescent in the throat, tube (1.5–)2–5(–6) mm long, lobes (5–)6–9 mm long, lepidote, stamens 5–10, pubescent in their lower part (7–)9–12(–13) mm long. Ovary 2 mm long, pale lepidote with a narrow basal pubescent band. Style 10.5–15 mm long, considerably or sometimes only slightly exceeding the stamens, glabrous. Stigma capitate. Capsule ovoid 4–6 mm long, lepidote; calyx persistent.

SIBERIA, JAPAN, KOREA, SCANDINAVIA, GREENLAND, CANADA AND ALASKA, with southern outliers in eastern and mid UNITED STATES AND BRITISH COLUMBIA. See maps in Hultén, Amphi-Atlantic Plants, p. 201 (1958); Hultén, Fl. Alaska, p. 718 (1968); and Wiggins & Thomas, Fl. Alask. North Slope, p. 398 (1968).

Individual collections not cited.

This species was the first of the Section to be known and the sectional name is derived from it. Apart from the very local and sympatric species, *R. burjatium*, this is the only member of the Section to occur outside the Sino-Himalayan region. Its wide, almost circum-arctic distribution is remarkable in the Section and in the genus as a whole. Hultén (1958, 1968, 1973) has discussed the relationship with *R. parvifolium* Adams. We agree with his conclusion that these are conspecific. Stapf (1931) summarized the history of these plants, but hesitated to take the formal step of uniting them. The low-growing form was introduced to cultivation from North America in 1825. This form is figured in the *Botanical Magazine* (t.3106, 1831) with the following note: "The enterprise of Mr Cunningham has been rewarded by having first in Britain brought to flower *Andromeda hypnoides* and *Rhododendron lapponicum*. These two interesting plants may be seen under the same hand glass in the nursery at Comely Bank near Edinburgh; they were both brought from Canada by Mr Blair in 1825". This arctic-alpine form does not persist in cultivation. The Siberian form was introduced into cultivation at a very early date, since Pallas figures a cultivated specimen in his *Flora Rossica* (1788). It has been re-introduced since, e.g. by E. Regel about 1877, and has proved much more tolerant of garden conditions.

24. *R. capitatum* Maxim. in Bull. Acad. Imp. Sc. St. Petersburg. 23:351 (1877). Syn.: "*R. fastigiatum* Franchet" Hemsley & Wilson, p.p. Kew Bull. 117 (1910); Rehder & Wilson in Sargent, *Plantae Wilsonianae* 1:507 (1913).

Type. Kansu, Przewalski 22 (holo. LE).

Shrub up to 1.5 m high with elliptic or oblong-elliptic leaves usually 10–18 mm, the under side pale tan with darker speckling. Calyx variable, often with unequal membranous lobes to 6 mm long, pilose or lepidote at base, margin ciliate. Style length variable.

Shrub, compact and rounded, up to 1.5 m high. Branches of the current year reddish-brown lepidote, sometimes puberulous. Leaves either dispersed along the shoots or crowded at the ends, petiole 1–2(–3) mm long, densely lepidote, blade (7–)10–18(–22) × (3–)5–9 mm, elliptic or oblong-elliptic (fig. 3x), apex rounded, emucronate, base broadly cuneate, margin flat to sub-revolute, mid-rib obscurely channelled above, raised below, upper surface dull green with impressed discontinuous to contiguous scales with colourless shining margins and amber centres, under surface pale tan with darker speckling, the pale grey-green surface either visible between the scales or obscured, the contiguous to discontinuous scales bicolorous, either colourless to straw coloured with pale golden centres, or tan to dark amber with darker centres, the paler scales usually predominant or more or less equal in number to the darker, or more rarely the darker scales predominate. Inflorescence 3–5-flowered; pedicel 1–3 mm, pilose or lepidote, lengthening slightly in fruit. Calyx variable, often with unequal membranous lobes to 6 mm long (more rarely all lobes shorter), rounded or irregularly lobed, pilose or lepidote at base, margin ciliate, very rarely with a few marginal scales (fig. 1 H–J). Corolla pale lavender to bluish purple or deep purplish red, broadly funnel-shaped, pubescent in the throat, the outer surface glabrous or minutely pubescent on the tube; tube 3–5 mm long; lobes 7–10 mm long. Stamens 10 (or one imperfect), 9–15 mm long, filaments hairy in lower

parts. *Ovary* 2 mm long, pale lepidote with a narrow basal pubescent band. *Style* 6–13 mm long, usually slightly exceeding the stamens, glabrous, or pubescent. *Stigma* discoid. *Capsule* ovoid, 5–6 mm long, lepidote; calyx persistent.

KANSU, adjacent east TIBET, SZECHUAN and SHENSI: from the Nan Shan north of Sining southwards past the gorges of the Yellow River (Hwang Ho) to Matang and eastwards to Sungpan and the Tsinling Shan (fig. 7).

Ching 524 (A, E, NY, US); 603 (E, US); 871 (E, US); 951 (A, E, US); *Farrer* 119 (E); 511 (E); 512 (E); *Hummel* 4244 (S); 4244a (S); 4358 (S); 4510 (S); *Licent* 2898 (K); *Przewalski* s.n. 1872 (E); s.n. 1880 (K); *Purdum* 440 (A); 1112 (A, E, K); s.n. (A); *Rock* 12191 (A, UPS, US); 12371 (A, F, NY); 12376 (A, UPS); 12471 (A, E); 12518 (A, E, K); 12647 (A); 12731 (A, F, NY); 13596 (A, UPS, US); 13598 p.p. (F, NY); 13600 (A, UPS, US); 13605 (A, NY); 13611 (A); 13622 (A, F); 13634 (A); 13635 (A, E, K); 13674 (A); 13688 (A, E, K); 13905 (A); 13956 (A, UPS, US); 13968 (A, E, K); 14006 (A, E, UPS, US); 14041 (A, F); 14045 (A, NY); 14101 (A, E, K); *Smith* 2601 (GB, S); 3701 (GB); 4390 (GB).

First collected by Przewalski in 1872. *Farrer* introduced his No. 119 to cultivation and it persisted until at least 1926 (*Cox*, 1926, where it is listed, p. 219, as *R. violaceum*). A plant collected by *Rock* in 1925 (*Rock* 13605) is still in cultivation at Edinburgh. However, this species is found in very few gardens. It ranges in altitude from 3000–4300 m, occurring in forests of *Picea* and *Abies*, in moist meadows with *Salix* and also on grassy and rocky mountainsides where it may dominate the slopes like heather. The paler and darker scales on the under side of the leaf show variation in their contrast and in their relative numbers. The calyx is also variable as to size, regularity, shape and tomentum. These variations often occur on the same plant and even in the same inflorescence. *R. nitidulum* which occurs to the south of this species, differs in the usually uniform colouring of the scales on the under surface of the leaf. Since the southernmost collections of *R. capitatum* show less contrast between the two scale colours than those to the north, further collecting may well reveal continuous gradation between *R. capitatum* and *R. nitidulum*. In other respects these species are similar.

25. *R. russatum* Balf. f. & Forrest in Notes R.B.G. Edinb. 9:126 (1919).

Syn.: *R. cantabile* Balf. f. ex Hutch. in Bot. Mag. t.8963 (1922).

R. osmerum Balf. f. & Forrest ex Stevenson, The Species of Rhododendron p. 425, 1930, in synonymy.

Type. Yunnan, on the Kari pass, 3650 m, vi 1917, *Forrest* 13915 (holo. E; iso. K).

Shrub from 30–150 cm high with elliptic leaves 16–40 mm long. Under side of leaf heavily speckled brown or rust, or almost uniformly red-brown. *Calyx* lobes broadly oblong, up to 6 mm long, with few scales or lepidote, margin long ciliate and sometimes with a few scattered scales. *Style* usually heavily pubescent.

Shrub from 30 to 150 cm high. *Branches* of the current year with dark brown stalked scales. *Leaves* either dispersed along the shoots or somewhat congested at their ends, petiole 2–7 mm long, fulvous lepidote, blade 16–40 × 6.5–17 mm, narrowly to broadly elliptic or oblong (fig. 3y), obtuse or rounded, mucronate, base cuneate, sometimes decurrent on the petiole, margin sub-revolute, mid-rib channelled above, raised below, lateral veins often visible, upper surface dark green bearing contiguous to discontinuous intermixed

pale and dark scales, under surface heavily speckled brown or rust, or almost uniformly red-brown, the scales contiguous with some leaf surface visible to slightly discontinuous, the colour varying in the same leaf from pale to darker shades of brown or rust, with or without darker centres, sometimes more or less uniformly dark rust. *Inflorescence* up to about 6-flowered; pedicels 1-2(-5) mm long, lepidote. *Calyx* up to 6 mm long, lobes broadly oblong, irregular in outline distally, with a few scales at the base and in a central band or elepidote, sometimes pubescent, margin long ciliate and sometimes with a few scattered scales, (fig 1C). *Corolla* deep indigo blue, purple, pink or rose, broadly funnel-shaped, pubescent in the throat and often on the outside of the corolla, elepidote; tube 4-9 mm long; lobes 6-11 mm long. *Stamens* 10(9-11) with a tuft of woolly hairs near the base of the filaments, 9.5-20 mm long. *Ovary* 2-3 mm long, covered with pale scales except for a narrow basal pubescent band, and sometimes with a tuft of hairs at the apex, style 14-20 mm long, heavily pubescent up to half its length, or sparingly pubescent. *Stigma* discoid. *Capsule* ovoid, about 6 mm long, lepidote, usually with persistent apical hairs; calyx persistent.

YUNNAN, SZECHUAN: extending from the Kari Pass and Muli southwards to the Likiang Range, Chungtien and the Mekong-Yangtze divide as far as 26°40' N latitude (fig. 10).

Ching 20601 (A); 20860 (A); 20867 (A); 21952 (A); 21961 (A); 21965 (A); 21970 (A); 21998 (A); *Feng* 913 (A); 1156 (A); *Forrest* 15440 (E); 16349 (E); 16371 (E, K); 16374 (E); 17293 (E); 19440 (BM, E); 19458 (E); 20950 (E); 20976 (E); 21026 (E); 22517 (E); 22594 (E); 22596 (E); 25500 (BM, E); 25502 (BM, E); 25553 (E); 25955 (BM, E); *Goodspeed* 32/1414 (E); *McLaren* D262 (BM, E); D264 (BM, E); *Rock* 3514 (E, K); 4171 p.p. (E, US); 8457 (E); 8602 (E, K); 8936 (A, E); 9173 (E, K); 9192 (A, K, US); 9194 (A, E); 11294 (E); 11295 (E); 11296 (E); 11318 (A, E, US); 17171 (E, US); 17179 (E); 18462 (A, E, NY, US); *Yü* 10682 (A, E); 11587 (A); 11613 (A); 13984 p.p. (A).

R. russatum was first collected in 1917 by George Forrest on the Kari Pass and this specimen became the type of the name. The type number was introduced by Forrest and is still growing at Edinburgh. Subsequent introductions include *Forrest* 19458 (Gard. Chron. 81:333, 1927). *R. cantabile* Hutch. was described from material cultivated by Mr J. C. Williams of Caerhays Castle, Cornwall, and appears to have been raised from seed introduced by Forrest in 1918 (though the number cited, *Forrest* 16583, is, in fact, *R. rupicola*). *R. russatum* is now a well-known garden plant, which has been used in hybridization. It is an aromatic shrub growing on alpine pasture and on the margins of pine and mixed forests, ranging in altitude from 3400-4300 m. It is one of the largest species of Section *Lapponicum*, but all its characters, including the papillate cells of the lower leaf epidermis, are typical of the Section.

NATURAL HYBRIDS. On the Chienchuan-Mekong divide (26°40' N 99°40' E) in 1922 George Forrest collected a suite of specimens which are intermediate in character between *R. russatum* and *R. rupicola* var. *rupicola*, and in which characteristics of *R. polycladum* also occur. In the following year, in the same area (26°40' N 99°30' E), Forrest collected a similar, but larger, suite of specimens. His numbers from this area referred to this hybrid swarm are: *Forrest* 21490-E; 21506-BM, E; 21529-BM, E; 21987-BM, F; 21990-BM, E; 21995-E; 22295-BM, E; 23347-E; 23349-BM, E; 23350-E; 23351-BM, E; 23354-BM, E; 23358-BM, E; 23359-E; 23363-BM, E;

23364—BM, E; 23366—BM, E; 23367—BM, E; 23370—BM, E; 23390—E; 23397—BM, E; 23398—BM, E. Other collections representing hybrids between *R. russatum* and *R. rupicola* are: *Ching* 20650—A; *Forrest* 25931 p.p.—E; *Rock* 4171 p.p.—A. 4261—E; 5391—E; 9523—E; 9554—E; 9560 p.p.—A; 9561—E; 9579—E; 11284—E. *Rock* 24694—E, NY probably represents a hybrid between *R. russatum* and some undetermined species.

26. *R. rupicola* W. W. Smith in Notes R.B.G. Edinb. 8:203 (1914).

var. ***rupicola***

Type. Yunnan, western flank of the Lichiang range, 4260 m, vi 1910, *Forrest* 5865 (holo. E; iso. A, BM).

Syn.: *R. achroanthum* Balf. f. & W. W. Smith in Notes R.B.G. Edinb. 9:208 (1916).

R. propinquum Tagg in Rhodo. Soc. Notes 3:30 (1925)—nomen nudum.

A low shrub with broadly elliptic or oblong leaves up to 21 mm long, with the under surface heavily stippled reddish-brown on a fawn background. The calyx lobes broadly strap-shaped, usually reddish purple with a broad central band of pale scales, margins ciliate rarely with reddish scales intermingled. Corolla lepidote.

A much branched shrub up to 60 cm or occasionally as tall as 120 cm. Branches of the current year densely covered with dark brown to black scales. Leaves usually clustered at the ends of the shoots, petiole 1–3(–4.5) mm long, dark lepidote, blade 6.5–21 × 3–12.7 mm, broadly elliptic to elliptic (fig. 32), oblong or ovate, apex rounded, mucronate, the mucro often recurved, base broadly cuneate to truncate, margin sub-revolute, sometimes cartilaginous, mid-rib channelled above, raised below, upper surface dull medium grey, bearing discontinuous to contiguous pale amber scales often with dark scales intermixed, under surface heavily stippled reddish-brown on a fawn background, the scales overlapping to slightly apart, bicolorous, dark brown or amber and pale gold, the darker scales usually predominant or more or less equal in number to the paler (and the dark colouring often intensified by fungal infection). Inflorescence up to 6-flowered, rarely more; pedicels 2–4 mm long, rarely longer, lepidote, rarely also pubescent. Calyx (2.5–)4–5(–6) mm long, lobes oblong or broadly ovate, apex obtuse or rounded, rarely deltoid, typically coloured dark reddish-purple, with a broad central band of pale scales, occasionally shortly pubescent, margin ciliate, rarely with reddish scales intermingled (fig. 1 D–E). Corolla typically intense purple, occasionally deep crimson or magenta, very rarely white, broadly funnel-shaped, pubescent in the throat and sometimes on the outside, with pale (or some darker) scales on the outside of the corolla, tube 3–6(–8) mm long, lobes (5–)7–10 mm long. Stamen number variable even in the same inflorescence, all numbers between 5 and 10 frequent, flowers with as many as 12 or as few as 3 stamens rarely occur, imperfect stamens often present, pubescent in the lower part, (8–)9–16 mm long. Ovary 2–3 mm long, either entirely pubescent, or bearing pale scales on the upper $\frac{2}{3}$ or less of its surface, occasionally with an apical tuft of hairs, style 10–19 mm, rarely shorter, pubescent to varying degrees or sometimes glabrous, coloured. Stigma discoid or lobulate. Capsule broadly ovoid, 4–6 mm long, pubescent, lepidote above, enclosed in the persistent calyx.

TIBET, BURMA, YUNNAN, SZECHUAN: a wide range extending eastwards from the Ata Kang La to Muli and beyond Yungning. Also southwards to the Burma-Yunnan border at about 26° N, and to Chienchuan and Likiang (fig. 10).

Ching 20871 (A); 30249 (A); *Farrer* 1047 (E); 1702 (E); *Feng* 1115 (A); 1594 (A); 2526 (A); *Forrest* 10314 (A, BM, E); 10340 (A, BM, E); 10367 (A, BM, E, K); 12508 (BM, E); 12581 (type of *R. achroanthum*—E); 12911 (BM, E); 15090 (BM, E); 15125 (BM, E); 15258 (E); 15270 (E); 15367 (E); 15391 (E); 15395 (E); 16580 (E); 16583 (E); 16586 (E); 16617 (BM, E); 17296 (E); 17297 (E); 17299 (E); 17439 (E); 17441 (E); 17442 (E); 17443 (E); 19719 (BM, E); 20464 (E); 20708 (E); 21283 (BM, E); 21975 (BM, E); 22543 (E); 23357 (BM, E); 24574 (E); 24576 (E); 24601 (E); 24986 (E); 25012 (BM, E); 25016 (BM, E); 25499 (E); 25501 (BM, E); 25523 (E); 25528 (BM, E); 25529 (E); 25532 (BM, E); 25554 (BM, E); 25907 (E); 25931 p.p. (E); 25941 (E); 25952 (E); 26987 (BM, E); 27119 (BM, E); 27571 (BM, E); 27591 (BM, E); 27810 (E); 28343 (E); 29304 (E); 29894 (E); 30395 (E); 30541 (E); 30889 (E); *Goodspeed* 33/1403 (E); *Handel-Mazzetti* 6862 (A, E, US); *McLaren* P90 (BM, E); 95D (E); D96 (BM, E); *Roch* 7 (E); 43 (E); 127 (E); *Rock* 3866 (A, E); 4258 (A, E, US); 4328 (A, E, US); 8949 (A, E, K); 8954 (A, E, K, US); 8955 (A, E, US); 9094 (E); 9362 (A, E, K, NY, US); 9370 (A, E, K, US); 9527 (E, K); 9560 p.p. (E); 9663 (A, E, K, US); 9722 (A, E, K, US); 9726 (A, E); 9731 (A, E, US); 9740 (A, E, K, US); 9751 (A, E, US); 11243 (E); 11434 (E); 17001 (BM, E, US); 17035 (E, US); 17113 (E, US); 18365 (E); 18367 (A, E, NY, US); 18442 (E, US); 18512 (A, E, NY, US); 18542 (BM); 22632 (A, E, NY); 23079 (A, BM, E, NY); 23467 (A, E, NY); 24805 (A, BM, E, F, K, NY, US); 25258 (BM, E, NY); 25277 (E, NY); 25302 (A, E, NY); *Schneider* 2179 (A, E); *Tsai* 58152 (A); *Wang* 63825 (A); 64653 (A); 64847 (A); 64909 (A); 64966 (A); 64983 (A); 66031 (A); 66131 (A); 67089 (A); 67094 (A); 67347 (A); 69502 (A); *Ward* 1794 (E); 3304 (E); 5298 (E); 5299 (E); 7048 (E, K); 9710 (BM); 10533 (BM); 13365 (BM); *Yü* 10687 (E); 13736 (A); 13984 p.p. (BM); 19741 (A); 20608 (E).

First collected in 1910 by George Forrest (no. 5865) on the western flank of the Likiang Range and it was from this material that the species was described. Forrest introduced it to cultivation at the same time (*Dict. of Gardening*, ed. Chittenden, 1951) and a flowering specimen which had been raised from seed from the type gathering was presented to the Kew herbarium in 1915 by Mr J. C. Williams. It occurs on open mountainsides, growing both on dry rocky slopes and in moist peaty meadows, often forming continuous low dense thickets. The leaves are usually aromatic but evidently individuals occur with leaves lacking the fragrance.

Despite considerable variability in a number of characters, *R. rupicola* var. *rupicola* is readily recognizable, especially by the shape of the leaf and the colouration of the scales on its lower surface, and by the characters of the calyx lobes. The degree of pubescence of the style is variable, as is that of the ovary. In all other species of Section *Lapponicum* there is only a narrow band of hairs around the base of the ovary, the remainder of its surface being covered with scales. In this species the scales may be more or less absent or cover as much as the upper $\frac{2}{3}$ of the ovary. The pedicels are typically moderate in length, but a specimen with young fruit collected by Roch (no. 7, Yunnan-Tibet border) has abnormally long pedicels. The flower colour is typically a deep purple, but may be less intense and in one gathering (*Forrest* 25529, Mekong-Yangtze divide, 27°25' N, 99°18' E) the flowers are described as "yellow-stained rose, and deeply margined purple-rose". As in several other species occasional white-flowered individuals have been recorded (*Forrest* 16586, mountains north-east of Chungtien, 28° N). Bayley Balfour used the variability in stamen number as one basis for distinguishing his *R. achroanthum* from this species. He considered that the stamen number of *R.*

rupicola was 10, although the original description of W. W. Smith records 8–10 stamens and we find flowers with as few as 7 stamens among the type gathering. The stamen number of *R. achroanthum* was described by him as 5 or 6. A large number of careful dissections has established that stamen number varies continuously from 5–10, and that the number can vary between flowers of the same plant and even of the same inflorescence. Imperfect stamens are frequent.

The description of *R. cantabile* Balf. f. ex Hutch. was drawn up from cultivated material which is preserved in the Kew herbarium. Hutchinson states that he had not seen the original specimen collected by Forrest (no. 16583) which he cites as the type of his species, but which is, in fact, *R. rupicola*. The cultivated material on which the description was based was from a plant of *R. russatum*, and we have placed this name under the synonymy of that species.

A very aberrant specimen, Ching 20859 from I-chi, northwest Likiang, has unicolorous dark red-brown scales on the under side of the leaves with the paler leaf surface visible between, the apex of the leaf is often tapered rather than rounded, and the colour of the corolla is described as white, the calyx lobes are typical of *R. rupicola* and the stamen number is about 5–6. We interpret this specimen as an aberrant form of *R. rupicola*.

NATURAL HYBRIDS. *R. rupicola* var. *rupicola* x *R. fastigiatum* [Rock 25036—BM, E, K]; *R. rupicola* var. *rupicola* x *R. impeditum* [Yü 13652—A]; *R. rupicola* var. *rupicola* x *R. nivale* subsp. *boreale* [Ward 10531—E]; *R. rupicola* var. *rupicola* x *R. russatum* [Ching 20650—A; Forrest 25931 p.p.—E; Rock 4171, p.p.—A; 4261—E, K; 5391—E; 9523—E, K; 9554—E; 9560 p.p.—A; 9561—E; 9579—E; 11284—E]; *R. rupicola* var. *rupicola* x *R. tapetiforme* [Ward 10005—E]; *R. rupicola* var. *rupicola* x *R. yungningense* [Forrest 29260, p.p.—E]. A hybrid swarm between *R. rupicola* var. *rupicola* and *R. russatum* is referred to under the latter species.

var. *chryseum* (Balf. f. & Ward) Philipson & Philipson, **comb. et stat. nov.**
Syn.: *R. chryseum* Balf. f. & Ward in Notes R.B.G. Edinb. 9:219 (1916). Type. Tibet/Yunnan frontier. Ka-gwr-pw glacier valley, 3960–4570 m, vi 1912, Ward 540 (holo. E).

Differs from the preceding variety only in the yellow colour of the corolla. TIBET, BURMA, YUNNAN: common in the region where Tibet, Burma and Yunnan meet. Yellow flowered individuals also occur sporadically in other parts of the range of *R. rupicola* (Chungtien plateau, Feng 1440; North west Likiang, I-chi, Ching 20863) (see fig. 10).

Ching 20863 (A); Feng 1440 (A); Forrest 13947 (E, K); 14000 (BM, E); 14005 (E); 14900 (E); 16579 (BM, E); 16681 (BM, E, K); 18655 (E); 19187 (E); 19607 (BM, E); 19655 (E); 19866 (E); 19896 (E); 19993 (E); 20843 (E); 20956 (E); 21749 (E); Handel-Mazzetti 9306 (E); Rock 6414 (A); 9249 (A, US); 9319 (A, US); 9365 (A, E, K, US); 9958 (A, US); 10081 (A, US); 10126 (A, E); 10914 (A, US); 11126 (A); 11148 (US); 11198 (A, US); 22063 (A, BM, NY); 22498 (E, NY); 22806 (E, NY); 22902 (E, K, NY); 22943 (A, BM, K, NY); 23153 (A, K, NY, US); 23210 (A, K, NY); 23360 (E, K, NY); 23398 (E, NY); 23540 (A, K, NY); Soulié 1005 (E); Wang 64826 (A); 65551 (A); 66459 (A); Ward 577, co-type (not seen); 5327 (E); 5337 p.p. (E); 9609 (E); Yü 6205 (A); 6825 (A); 7863 (A); 7887 (A, E); 7995 (A); 8624 (A, BM); 10779 (A); 14548 (A); 19065 (A); 19358 (A); 19792 (A); 22133 (A).

R. rupicola var. *chryseum* was first collected at Sela (SiLa) by Soulié in the last decade of the nineteenth century, but was not described until Kingdon Ward collected it on the Ka-gwr-pw in 1912. The striking colour of the flower lead to its being given specific rank, but since it appears identical with *R. rupicola* in all other respects, including the variability of stamen number, the colour difference does not warrant more than varietal status—a view foreshadowed by F. Kingdon Ward in the *Gardeners' Chronicle* 95:126 (1934). In the majority of specimens the margin of the calyx lobes is densely ciliate (as in var. *rupicola*), but rarely gatherings from this area have lepidote margins similar to those of var. *muliense* (e.g. *Rock* 10126 and *Yü* 19792). The plant figured in the *Botanical Magazine* (t.9246, 1931) was introduced by George Forrest in 1918 (*Forrest* 16681) but the variety evidently had been introduced by Ward when he re-discovered it, as 1912 is given as the date of introduction in *The Dictionary of Gardening* (ed. Chittenden, 1951). It is relatively successful as a garden plant. Its natural habitats include coniferous forests and open moorland and rocky mountainsides between 3300 m and 4750 m.

NATURAL HYBRIDS. *R. rupicola* var. *chryseum* x *R. tapetiforme* [*Forrest* 14074—E, K]. See under *R. tapetiforme* for a discussion on *R. chamaezelum* Balf. f. & Forrest.

var. *muliense* (Balf. f. & Forrest) Philipson & Philipson, **comb. et stat. nov.** Syn.: *R. muliense* Balf. f. & Forrest in *Notes R.B.G. Edinb.* 11:101 (1919). Type. Szechuan, SW, Mu-li mts, valley of Li-tang river, 3650–3960 m, vi 1918, *Forrest* 16252 (holo. E; iso BM, K).

Differs from *R. rupicola* var. *rupicola* in the yellow colour of the corolla and from that variety and var. *chryseum* in the calyx lobes being typically margined with brownish-red scales usually with hairs intermingled. In addition, the shape of the leaf is often narrowly oblong rather than broadly elliptic (fig. 32²), and generally there is less contrast between the two scale colours on the under side of the leaf due to the darker scales being tan rather than dark brown, and the number of the stamens is more constantly ten.

SZCHUAN: most frequently collected in an area around Muli, Kulu and Wachin, but also in the Minya country south-west of Tatsienlu (see fig. 10). *Forrest* 17115 (E); 20432 (BM, E); 21054 (E); 21345 (BM, E); 29249 (E); 29272 (E); 30942 (E); *Goodspeed* 32/2313 (E); *Handel-Mazzetti* 2623 (US); *Rock* 5488 (E); 5543 (E); 16178 (E); 16479 (A, US); 16480 (E, K); 17459 (E, NY); 17482 (E); 17491 (E); 17897 (BM, E); 17950 (E, NY); 17967 (A, E, K, NY); 18224 (NY, US); 23853 (E, K, NY); 23854 (BM, K, NY); 23967 (E, K, NY); *Schneider* 4084 (A); *Ward* 4023 (E); 4429 (E); 5152 (E); *Yü* 7040 (A); 14641 (A).

This variety was first collected by Schneider and Handel-Mazzetti in 1914, but was not described until George Forrest collected it near Muli in 1918. Balfour considered it specifically distinct from *R. chryseum*, but more recently these two species have been thought to be conspecific (Sunge, 1967). However, the differences in calyx and foliage between the eastern and western areas, even if not absolutely invariable, are sufficiently consistent to justify separation of these two yellow-flowered populations, especially as the stamen number is consistently ten in var. *muliense*. They are both regarded

here as yellow-flowered varieties of the widespread species *R. rupicola*. This variety is in cultivation but is usually not distinguished from *R. chryseum*. We have seen no published record of its introduction to cultivation and have not seen in gardens either of the numbers from Forrest's 1917-19 expedition. However, a collection from his 1921-22 expedition is growing at Windsor (no. 20432) as well as introductions from later expeditions (e.g. no. 29249). A Kingdon Ward collection (no. 4023, 1921) is also at Windsor. *R. rupicola* var. *muliense* occurs among pine and larch groves and on open grasslands and alpine meadows ranging between 3050 m and 4875 m in altitude.

NATURAL HYBRIDS. *R. rupicola* var. *muliense* x *R. impeditum* [Rock 18187—A, NY]; *R. rupicola* var. *muliense* x *R. nivale* subsp. *boreale* [Rock 16477—A, E, NY, US].

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REFERENCES

- BALFOUR, I. B. (1916). New Species of *Rhododendron*. *Notes R.B.G. Edinb.* 9:207-320.
 BUSCH, N. (1915). *Flora Siberia et Orientis Extremi*, vol. 2. Leningrad.
 BUSCH, E. (1952). In Komarov, *Flora URSS* vol. 18. Leningrad.
 CHITTENDEN, F. J., ed. (1951). *Dictionary of Gardening*, vol. 4. Oxford.
 COX, E. H. M. (1926). *Farrer's Last Journey*. London.
 DON, D. (1821). New Plants from Nepaul. *Mem. Wern. Soc. Edinb.* 3:407-415.
 FANG, WEN-PEI (1939). *Rhododendrons collected by recent Chinese Expeditions. Contr. Biol. Lab. Sci. Soc. China* 12:1-88.
 FORBES, F. B. & HEMSLEY, W. B. (1889-1902). Enumeration of all the plants known from China proper, Formosa, Hainan, the Corea, the Luchu Archipelago and the island of Hongkong; together with their distribution and synonymy (Pt. 2). *Journ. Linn. Soc. (Bot.)* 26:1-592.
 HOOKER, J. D. (1849). *The Rhododendrons of Sikkim-Himalaya*. London.
 HULTÉN, E. (1958). *The Amphi-Atlantic Plants*. Stockholm.
 — (1968). Comments on the Flora of Alaska and Yukon. *Arkiv Bot.* 7:1-128.
 — (1973). Supplement to Flora of Alaska and Neighbouring Territories. A Study of the Flora of Alaska and the Transberingian Connection. *Bot. Notiser* 126:459-512.
 LINNAEUS, C. (1753). *Species Plantarum*. Stockholm.

- MALYSHEV, L. (1961). De Speciebus Novis et Raris e Sajan Orientali. *Not. Syst. Herb. Inst. Bot. Acad. Sci. URSS* 21:451-460.
- MAXIMOVICZ, C. J. (1877). Diagnoses plantarum novarum asiaticarum. *Bull. Acad. Imp. Sc. St. Petersburg* 23:707-831.
- PHILIPSON, M. N. & PHILIPSON, W. R. (1975). A New Species of *Rhododendron* from Yunnan. *Notes R.B.G. Edinb.* 33:493-494.
- ROCK, J. F. (1947). *The Ancient Na-Khi Kingdom of Southwest China*. Harvard.
- SLEUMER, H. (1949). Ein System der Gattung *Rhododendron* L. *Bot. Jahrb.* 74:511-553.
- SMITH, W. W. (1914). Diagnoses specierum novarum in herbario Horti Regii Botanici Edinburgensis cognitarum (Species chinenses). *Notes R.B.G. Edinb.* 8:173-212.
- STAFF, O. (1931). *Rhododendron parvifolium*. *Bot. Mag.* t.9229.
- STEVENSON, J. B. (1930). *The Species of Rhododendron*. London.
- SYNGE, P. M., ed. (1967). *Rhododendron Handbook, Pt. 1. Rhododendron Species in General Cultivation*. London.
- WIGGINS, I. L. & THOMAS, J. H. (1962). *A Flora of the Alaskan Arctic Slope*. Toronto.

APPENDIX I

List of Synonyms

- Azalea ferruginosa* Pallas = lapponicum; *A. lapponica* L. = lapponicum; *A. parvifolia* Kuntze = lapponicum.
- Rhododendron achroanthum* Balf. f. & W. W. Smith = rupicola var. rupicola; *R. alpicola* Rehder & Wilson = nivale ssp. boreale; *R. alpicola* var. *strictum* Rehder & Wilson = nivale ssp. boreale.
- R. batangense* Balf. f. = nivale ssp. boreale; *R. blepharocalyx* Franchet = intricatum.
- R. cantabile* Balf. f. = russatum; *R. chamaezelum* Balf. f. & Forrest = tapetiforme x rupicola var. chryseum; *R. cheilanthum* Balf. f. & Forrest = cuneatum; *R. chryseum* Balf. f. & Ward = rupicola var. chryseum; *R. cinereum* Balf. f. = cuneatum; *R. compactum* Hutch. = polycladum; *R. confertissimum* Nakai = lapponicum.
- R. diacritum* Balf. f. & W. W. Smith = telmateium; *R. drumonium* Balf. f. & W. W. Smith = telmateium.
- R. edgarianum* Rehder & Wilson = nivale subsp. boreale x indet. parent.
- R. ferrugineum* Georgi = lapponicum; *R. fimbriatum* Hutch. = hippophaeoides.
- R. glomerulatum* Hutch. = yungningense.
- R. idoneum* Balf. f. & W. W. Smith = telmateium.
- R. lapponicum* var. *albiflorum* Herder = lapponicum; *R. lapponicum* var. *genuinum* Herder = lapponicum; *R. lapponicum* var. *parvifolium* (Adams.) Herder = lapponicum; *R. litangense* Balf. f. = impeditum; *R. lysolepis* Hutch. = flavidum x indet. parent.
- R. microleucum* Hutch. = orthocladum var. microleucum; *R. muliense* Balf. f. & Forrest = rupicola var. muliense.
- R. nanum* H. Lév. = fastigiatum; *R. nigropunctatum* Franchet = nivale ssp. boreale; *R. nitidulum* var. *nubigenum* Rehder & Wilson = nitidulum.
- R. oreinum* Balf. f. = nivale ssp. boreale; *R. oresbium* Balf. f. & Ward = nivale ssp. boreale; *R. osmerum* Balf. f. & Forrest = russatum.
- R. paludosum* Hutch. & Ward = nivale ssp. nivale; *R. palustre* Turcz. = lapponicum; *R. parviflorum* F. Schmidt = lapponicum; *R. parvifolium* Adams = lapponicum; *R. parvifolium* var. *albiflorum* Herder = lapponicum; *R. parvifolium* forma *alpina* Glehn = lapponicum; *R. parvifolium* forma *elata* Glehn = lapponicum; *R. peramabile* Hutch. = intricatum; *R. polifolium* Franchet = thymifolium; *R. primulinum* Hemsley = flavidum; *R. propinquum* Tagg = rupicola var. rupicola; *R. pycnocladum* Balf. f. & W. W. Smith = telmateium.
- R. ramosissimum* Franchet = nivale ssp. boreale; *R. ravum* Balf. f. & W. W. Smith = cuneatum.

- R. scintillans* Balf. f. & W. W. Smith = *polycladum*; *R. sclerocladum* Balf. f. & Forrest = *cuneatum*; *R. semanteum* Balf. f. = *impeditum*; *R. spilantherum* Hutch. = *thymifolium*; *R. stictophyllum* Balf. f. = *nivale* ssp. *boreale*.
R. verruculosum Rehder & Wilson = *flavidum* x *indet.* parent.; *R. vicarium* Balf. f. = *nivale* ssp. *boreale*; *R. violaceum* Rehder & Wilson = *nivale* ssp. *boreale*.
R. yaragongense Balf. f. = *nivale* ssp. *boreale*.

APPENDIX 2

COLLECTORS' NUMBERS
(excluding those of *R. lapponicum*)

- Aufschnaiter: 14800, *nivale* ssp. *nivale*.
 Bonvalot & Prince Henry of Orleans: s.n., *nivale* ssp. *boreale*.
 Bor & Kirat Ram: 20484, 20801, *nivale* ssp. *nivale*.
 Bowes-Lyon: 2098, *nivale* ssp. *nivale*.
 Chapman: 70, 109, 159, *nivale* ssp. *nivale*.
 Chiao: 1843, *thymifolium*.
 Chiao & Fan: 703, *nitidulum* v. *omeiense*.
 Ching: 523, *thymifolium*; 524, 603, *capitatum*; 608, *thymifolium*; 871, 951, *capitatum*; 20322, 20325, 20327, *cuneatum*; 20328, *telmateium*; 20496, 20599, 20600, *yunngningense*; 20601, *russatum*; 20608, *yunngningense*; 20650, *russatum* x *rupicola*; 20859, *rupicola* v. *rupicola*; 20860, *russatum*; 20862, *yunngningense*; 20863, *rupicola* v. *chryseum*; 20867, *russatum*; 20871, *rupicola* v. *rupicola*; 21609, *orthocladum* v. *longistylum*; 21952, 21961, *russatum*; 21962, *hippophaeoides* v. *hippophaeoides*; 21965, 21970, 21998, *russatum*; 30031, *cuneatum*; 30126, *impeditum*; 30156, *cuneatum*; 30159, *impeditum*; 30198, *cuneatum*; 30233, *telmateium*; 30249, *rupicola* v. *rupicola*.
 Cooper: 3483, 3838, *nivale* ssp. *nivale*.
 Cunningham: s.n. (1923) *thymifolium*.
 Delavay: 267, *fastigiatum*; 267 bis, *polycladum*; 360, *fastigiatum* & *telmateium*; 737, *fastigiatum* & *polycladum*; 4333, *telmateium*; s.n. (1886), s.n. (1887), s.n. (1888), *fastigiatum*.
 Exbury: cult at Kew, *orthocladum* v. *microleucum*.
 Faber: 483, *nitidulum* v. *omeiense*.
 Fang: 3604, 3693, *thymifolium*; 18982, *nitidulum* v. *omeiense*.
 Farrer: 119, *capitatum*; 510, *thymifolium*; 511, 512, *capitatum*; 1047, 1702, *rupicola* v. *rupicola*.
 Feng: 317, 651, *cuneatum*; 890, 902, *hippophaeoides* v. *hippophaeoides*; 913, *russatum*; 1110, *complexum*; 1115, *rupicola* v. *rupicola*; 1141, *telmateium*; 1155, *yunngningense*; 1156, *russatum*; 1270, *cuneatum*; 1440, *rupicola* v. *chryseum*; 1456, *telmateium*; 1594, *rupicola* v. *rupicola*; 2524, *hippophaeoides* v. *hippophaeoides*; 2526, *rupicola* v. *rupicola*.
 Forrest: 2181, *telmateium*; 4149, *fastigiatum*; 5534, *telmateium*; 5847, 5863, *fastigiatum*; 5865, *rupicola* v. *rupicola*; 5876, *impeditum*; 5879, *telmateium*; 6738, *cuneatum*; 6757, *fastigiatum*; 10014, 10015, *polycladum*; 10035, *yunngningense* & *impeditum*; 10055, *impeditum*; 10059, *cuneatum*; 10070, *telmateium* & *impeditum*; 10071, 10157, *cuneatum*; 10284, *fastigiatum*; 10311, *complexum* & *impeditum*; 10314, *rupicola* v. *rupicola*; 10333, *hippophaeoides* v. *hippophaeoides*; 10340, 10367, *rupicola* v. *rupicola*; 10423, *cuneatum*; 10424, 10434, *telmateium*; 10435, *cuneatum*; 10481, *orthocladum* v. *orthocladum*; 10610, *fastigiatum*; 11010, *telmateium*; 11450, *orthocladum* v. *orthocladum*; 11487, *hippophaeoides* v. *hippophaeoides*; 11497, *telmateium*; 11621, 11626, 11654, *fastigiatum*; 11730, 12417, *cuneatum*; 12461, *hippophaeoides* v. *hippophaeoides*; 12478, *telmateium*; 12508, *rupicola* v. *rupicola*; 12520, *complexum*; 12562, *hippophaeoides* v. *hippophaeoides*; 12568, *telmateium*; 12581, *rupicola* v. *rupicola*; 12614, 12623, *telmateium*; 12633, *hippophaeoides* v. *hippophaeoides*; 12665, *cuneatum*; 12911, *rupicola* v. *rupicola*; 13761, *cuneatum*; 13768, *telmateium*; 13791, 13792, 13793, 13794, 13799, 13800, 13842, *hippophaeoides* v. *hippophaeoides*; 13847, *telmateium*; 13899, *polycladum*; 13905, *dasyptetum*; 13915, *russatum*; 13947, *rupicola* v. *chryseum*; 13965, *tapetiforme*; 13987, *nivale* ssp. *boreale*; 14000, 14005, *rupicola* v. *chryseum*; 14018, 14040, *nivale* ssp. *boreale*; 14074, *tapetiforme* x *rupicola* v. *chryseum*; 14085, *tapetiforme*; 14900, *rupicola* v. *chryseum*; 15033, *polycladum*; 15076, *impeditum*; 15085, *telmateium*; 15090, *rupicola* v. *rupicola*; 15091, *impeditum* & *fastigiatum*;

15094, *telmateium*; 15125, *rupicola* v. *rupicola*; 15132, 15154, *telmateium*; 15159, *complexum*; 15201, *impeditum*; 15210, *telmateium*; 15218, 15225, *cuneatum*; 15249, *fastigiatum*; 15251, *hippophaeoides* v. *hippophaeoides*; 15255, 15256, *telmateium*; 15258, *rupicola* v. *rupicola*; 15264, 15265, *hippophaeoides* v. *hippophaeoides*; 15267, *complexum*; 15268, *telmateium*; 15269, *complexum*; 15270, *rupicola* v. *rupicola*; 15356, *tapetiforme*; 15367, *rupicola* v. *rupicola*; 15370, 15372, 15386, *telmateium*; 15388, *hippophaeoides* v. *hippophaeoides*; 15391, *rupicola* v. *rupicola*; 15392, 15393, *complexum*; 15395, *rupicola* v. *rupicola*; 15400, *complexum*; 15407, *telmateium*; 15410, *polycladum*; 15427, *cuneatum*; 15440, *russatum*; 15448, *cuneatum*; 15450, *hippophaeoides* v. *hippophaeoides*; 15451, *orthocladum* v. *orthocladum*; 15459, *hippophaeoides* v. *hippophaeoides*; 15464, *cuneatum*; 15467, 15468, *telmateium*; 15612, 15613, 15614, 15615, 15617, *fastigiatum*; 15639, *telmateium*; 15640, *orthocladum* v. *orthocladum*; 15642, *complexum*; 15643, 15645, 15958, 15972, *telmateium*; 16128, *hippophaeoides* v. *hippophaeoides*; 16129, *cuneatum* 16252, *rupicola* v. *mulienae*; 16257, *telmateium*; 16263, *hippophaeoides* v. *hippophaeoides*; 16270, 16270B, *intricatum*; 16277, *impeditum*; 16282, *yungningense*; 16284, *impeditum*; 16287, *orthocladum* v. *orthocladum*; 16288, *telmateium*; 16289, *nivale* ssp. *boreale* & *impeditum* x *nivale* ssp. *boreale*; 16292, *impeditum*; 16296, 16300, *telmateium*; 16305, 16307, *nivale* ssp. *boreale*; 16313, *telmateium*; 16349, 16371, 16374, *russatum*; 16450, *tapetiforme*; 16500, 16545, *nivale* ssp. *boreale*; 16577, *tapetiforme*; 16579, *rupicola* v. *chryseum*; 16580, 16583, 16586, *rupicola* v. *rupicola*; 16598, *complexum*; 16617, *rupicola* v. *rupicola*; 16681, *rupicola* v. *chryseum*; 16977, 16981, *telmateium*; 16983, *impeditum*; 16985, *telmateium*; 16995, *complexum*; 16999, *orthocladum* v. *orthocladum*; 17034, 17035, *impeditum*; 17036, 17073, *intricatum*; 17107, *orthocladum* v. *orthocladum*; 17115, *rupicola* v. *mulienae*; 17116, 17117, 17118, *impeditum*; 17126, 17127, *telmateium*; 17129, *nivale* ssp. *boreale* x *impeditum*; 17132, *yungningense*; 17134, *nivale* ssp. *boreale*; 17293, *russatum*; 17294, *nivale* ssp. *boreale*; 17296, 17297, 17299, 17439, 17441, 17442, 17443, *rupicola* v. *rupicola*; 18648, *polycladum*; 18652, *telmateium*; 18655, 19187, *rupicola* v. *chryseum*; 19195, *nivale* ssp. *boreale*; 19201, *tapetiforme*; 19440, *russatum*; 19447, 19450, 19456, *polycladum*; 19458, *russatum*; 19597, *nivale* ssp. *boreale*; 19607, 19655, *rupicola* v. *chryseum*; 19674, *tapetiforme*; 19676, *nivale* ssp. *boreale*; 19719, *rupicola* v. *rupicola*; 19866, 19896, 19993, *rupicola* v. *chryseum*; 20208, *tapetiforme*; 20432, *rupicola* v. *mulienae*; 20450, *intricatum*; 20453, *telmateium*; 20454, *impeditum*; 20457, *telmateium*; 20460, *yungningense*; 20461, *telmateium*; 20462, *nivale* ssp. *boreale*; 20463, *yungningense*; 20464, *rupicola* v. *rupicola*; 20477, *telmateium*; 20488, *orthocladum* v. *orthocladum*; 20492, *impeditum*; 20493, *orthocladum* v. *orthocladum*; 20512, 20553, *telmateium*; 20601, *nivale* ssp. *boreale*; 20627, *orthocladum* v. *orthocladum*; 20638, *telmateium*; 20651, *orthocladum* v. *orthocladum*; 20698, *yungningense*; 20708, *rupicola* v. *rupicola*; 20714, *tapetiforme*; 20715, *nivale* ssp. *boreale*; 20843, *rupicola* v. *chryseum*; 20928, *nivale* ssp. *boreale*; 20949, *telmateium*; 20950, *russatum*; 20956, *rupicola* v. *chryseum*; 20968, 20969, *impeditum*; 20970, *intricatum*; 20976, *russatum*; 20977, *intricatum*; 21026, *russatum*; 21028, *intricatum*; 21030, *cuneatum*; 21031, *intricatum*; 21046, *telmateium*; 21054, *rupicola* v. *mulienae*; 21059, *cuneatum*; 21239, *telmateium*; 21241, *orthocladum* v. *orthocladum*; 21247, *telmateium*; 21248, *intricatum*; 21250, *telmateium*; 21274, *orthocladum* v. *orthocladum* x *impeditum*; 21276, *telmateium*; 21282, *yungningense*; 21283, *rupicola* v. *rupicola*; 21288, *orthocladum* v. *orthocladum*; 21289, *telmateium*; 21290, 21297, *yungningense*; 21301, *nivale* ssp. *boreale*; 21304, *yungningense*; 21305, *hippophaeoides* v. *hippophaeoides*; 21313, *yungningense*; 21344, *intricatum*; 21345, *rupicola* v. *mulienae*; 21369, 21375, *cuneatum*; 21377, *telmateium*; 21387, *impeditum*; 21424, 21436, *telmateium*; 21456, *cuneatum*; 21462, 21476, *hippophaeoides* v. *occidentale*; 21483, 21487, *polycladum*; 21490, *russatum* x *rupicola* v. *rupicola*; 21492, *nivale* ssp. *australe*; 21506, *russatum* x *rupicola* v. *rupicola*; 21507, *fastigiatum*; 21528, *polycladum*; 21529, *russatum* x *rupicola* v. *rupicola*; 21532, *fastigiatum*; 21547, *nivale* ssp. *australe*; 21559, *polycladum*; 21577, *telmateium*; 21581, *fastigiatum*; 21749, *rupicola* v. *chryseum*; 21922, 21932, *telmateium*; 21948, *cuneatum*; 21972, 21974, *nivale* ssp. *australe*; 21975, *rupicola* v. *rupicola*; 21987, *russatum* x *rupicola* v. *rupicola*, *polycladum* & *russatum* x *polycladum*; 21988, *orthocladum* v. *longistylum*; 21990, 21995, *russatum* x *rupicola* v. *rupicola*; 22108, 22110, *impeditum*; 22197, 22203, *cuneatum*; 22295, *russatum* x *rupicola* v. *rupicola*; 22299, *polycladum*; 22517, *russatum*; 22543, *rupicola* v. *rupicola*; 22548, *cuneatum*; 22594, 22596, *russatum*; 22968, *complexum*; 22969, *polycladum*; 22971, *complexum*; 22972, *yungningense*; 23005, *hippophaeoides* v. *occidentale*; 23024, *polycladum*; 23098, 23101, *hippophaeoides* v. *hippophaeoides*; 23102, *fastigiatum*; 23103, *yungningense*; 23108, *polycladum*; 23109, *hippophaeoides* v. *occi-*

- dentale*; 23112, *nivale* ssp. *australe*; 23113, *fastigiatum*; 23138, 23139, *polycladum*; 23140, *nivale* ssp. *australe*; 23141, *polycladum*; 23142, 23143, *nivale* ssp. *australe*; 23145, *polycladum*; 23146, *nivale* ssp. *australe*; 23147, *polycladum*; 23148, *nivale* ssp. *australe*; 23149, *hippophaeoides* v. *hippophaeoides*; 23152, *nivale* ssp. *australe*; 23153, 23154, *polycladum*; 23156, *fastigiatum*; 23340, *polycladum*; 23341, *hippophaeoides* v. *occidentale*; 23342, *fastigiatum*; 23343, *hippophaeoides* v. *occidentale*; 23344, *fastigiatum*; 23345, *nivale* ssp. *australe* & *polycladum*; 23346, *hippophaeoides* v. *hippophaeoides*; 23347, *russatum* x *polycladum*; 23348, *cuneatum*; 23349, 23350, 23351, *russatum* x *rupicola* v. *rupicola*; 23352, 23353, *cuneatum*; 23354, *russatum* x *polycladum* & *russatum* x *rupicola* v. *rupicola*; 23355, *cuneatum*; 23357, *rupicola* v. *rupicola*; 23358, *russatum* x *rupicola* v. *rupicola* & *polycladum*; 23359, *russatum* x *rupicola* v. *rupicola*; 23360, *telmateium*; 23361, *polycladum*; 23362, *nivale* ssp. *australe* & *nivale* subsp. *australe* x *polycladum*; 23363, 23364, *russatum* x *rupicola* v. *rupicola*; 23365, *polycladum*; 23366, *rupicola* v. *rupicola* x *russatum*; 23367, *russatum* x *rupicola* v. *rupicola*; 23368, *polycladum* & *nivale* ssp. *australe*; 23369, *nivale* ssp. *australe*; 23370, *russatum* x *rupicola* v. *rupicola*; 23390, *polycladum* x *rupicola* v. *rupicola*; 23397, 23398, *russatum* x *rupicola* v. *rupicola*; 24574, 24576, 24601, 24986, 25012, 25016, *rupicola* v. *rupicola*; 25496, *fastigiatum*; 25497, *hippophaeoides* v. *occidentale*; 25498, *polycladum*; 25499, *rupicola* v. *rupicola*; 25500, *russatum*; 25501, *rupicola* v. *rupicola*; 25502, *russatum*; 25523, *rupicola* v. *rupicola*; 25526, *yungningense*; 25528, 25529, 25532, *rupicola* v. *rupicola*; 25553, *russatum*; 25554, *rupicola* v. *rupicola*; 25555, *polycladum*; 25707, *nivale* ssp. *australe*; 25904, *polycladum*; 25907, *rupicola* v. *rupicola*; 25909, *nivale* ssp. *australe*; 25912, 25930, *polycladum*; 25931, *rupicola* v. *rupicola* & *rupicola* v. *rupicola* x *russatum*; 25941, 25952, *rupicola* v. *rupicola*; 25955, *russatum*; 25981, 25982, *fastigiatum*; 26987, 27119, 27571, 27591, 27810, *rupicola* v. *rupicola*; 28256, 28260, 28287, 28300, 28341, *fastigiatum*; 28343, *rupicola* v. *rupicola*; 28344, *telmateium*; 29112, *fastigiatum*; 29249, *rupicola* v. *mulienae*; 29251, *nivale* ssp. *boreale*; 29259, *yungningense*; 29260, *yungningense* & *yungningense* x *rupicola* v. *rupicola*; 29266, *intricatum*; 29268, *impeditum*; 29269, *telmateium*; 29272, *rupicola* v. *mulienae*; 29290, *polycladum* x indet. parent; 29304, *rupicola* v. *rupicola*; 29337, *yungningense*; 29338, *telmateium*; 29894, 30395, 30541, *rupicola* v. *rupicola*; 30885, *complexum*; 30889, *rupicola* v. *rupicola*; 30938, *telmateium*; 30941, *impeditum*; 30942, *rupicola* v. *mulienae*; 30997, *fastigiatum*.
- Goodspeed: 32/1393, *orthocladum* v. *orthocladum*; 32/1399, *telmateium*; 32/1413, *fastigiatum*; 32/1414, *russatum*; 32/1835, *cuneatum*; 32/1846, *hippophaeoides* v. *hippophaeoides*; 32/2313, *rupicola* v. *mulienae*; 32/2349, *polycladum* x indet. parent; 33/1403, *rupicola* v. *rupicola*.
- Gould: 2250, *nivale* ssp. *nivale*.
- Hanbury-Tracy: 167, *nivale* ssp. *nivale*.
- Handel-Mazzetti: 1414, *amundsenianum*; 1506, *tsaii* x *hippophaeoides* v. *hippophaeoides*; 2217, *tsaii* x *hippophaeoides* v. *hippophaeoides*; 2622, *impeditum*; 2623, *rupicola* v. *mulienae*; 6862, *rupicola* v. *rupicola*; 7544, *telmateium*; 9306, *rupicola* v. *chryseum*.
- Headfort: 154, *intricatum*; 166, *hippophaeoides* v. *hippophaeoides*; 328, *polycladum*.
- Henry: 8897, *nitidulum* v. *omeiense*.
- Hooker: s.n., *nivale* ssp. *nivale*.
- Hu: 8321, 8312, s.n., *nitidulum* v. *omeiense*.
- Hummel: 4244, 4244a, 4358, 4510, *capitatum*.
- Lee: 3476, *nitidulum* v. *omeiense*.
- Licent: 2898, *capitatum*; 4530, *thymifolium*.
- Ludlow & Sherriff: 1598, 1779, 1788, 2300, *nivale* ssp. *nivale*; 2622, *bulu*; 5950, 8653, 8824, 9537, 9575, 9979, *nivale* ssp. *nivale*.
- Ludlow, Sherriff & Elliot: 11610, 11804, 12120, *nivale* ssp. *nivale*; 12397, 12397a, *bulu*; 13125, *nivale* ssp. *nivale*; 13316, 13520, *bulu*; 13701, 13872, 15058, 15208, 15650, 15668, *nivale* ssp. *nivale*; 15729, *bulu*.
- Ludlow, Sherriff & Hicks: 16294, 18960, *nivale* ssp. *nivale*.
- Ludlow, Sherriff & Taylor: 3805, 3830, 3999, 4253, *nivale* ssp. *nivale*; 4277, 4440, 4496, *bulu*; 4784, 4826, *nivale* ssp. *nivale*; 4996, *bulu*; 5283, *nivale* ssp. *nivale*; 5664, 6213, *bulu*.
- McCosh: 362, *nivale* ssp. *nivale*.
- McLaren: B3, *fastigiatum*; Z3, *nivale* ssp. *boreale*; P23, *cuneatum*; P37, K37A, P41, *hippophaeoides* v. *hippophaeoides*; 44, *fastigiatum*; P51, *telmateium*; P70, P73, *cuneatum*; P74, *telmateium*; P90, *rupicola* v. *rupicola*; P92, *yungningense*; 95D, D96, *rupicola* v. *rupicola*; 113, C190, *fastigiatum*; D262, D264, *russatum*; D265, *polycladum*; AF475, *thymifolium*.

- Maire: 61, 223, s.n. (1911), *fastigiatum*.
 Malyshev: 4600, *burjaticum*.
 Morton: 16, 197, *nivale* ssp. *nivale*.
 Muir: s.n. (1911), *nivale* ssp. *boreale*.
 Mussot: 265, *nivale* ssp. *boreale*; 266, *thymifolium*.
 Polunin: 352, *nivale* ssp. *nivale*.
 Polunin, Sykes & Williams: 4, 28, 1141, 2205, *nivale* ssp. *nivale*.
 Pratt: 267, *websterianum* v. *websterianum*; 521, *flavidum* v. *flavidum*; 787, *thymifolium*; 802, *nitidulum* v. *omeiense*; s.n., *nitidulum* v. *omeiense*.
 Przewalski: s.n. (1873), *thymifolium*; 22, s.n. (1872), s.n. (1880), *capitatum*.
 Purdom: 440, 1112, s.n., *capitatum*.
 Richardson: 59, *nivale* ssp. *nivale*.
 Roch: 7, 43, 127, *rupicola* v. *rupicola*; 188, *fastigiatum*.
 Rock: 3152, *fastigiatum*; 3360, 3431, *telmateium*; 3455, *hippophaeoides* v. *hippophaeoides*; 3473, 3483, 3843A, *cuneatum*; 3498, *hippophaeoides* v. *hippophaeoides*; 3505, *impeditum*; 3514, *russatum*; 3563, *cuneatum*; 3575, 3818, *telmateium*; 3866, *rupicola* v. *rupicola*; 3867, *complexum*; 3897, *hippophaeoides* v. *hippophaeoides*; 3939, *telmateium*; 3970, *complexum*; 3974, *hippophaeoides* v. *hippophaeoides*; 4023, *fastigiatum*; 4080, *telmateium*; 4081, *cuneatum*; 4118, *telmateium*; 4170, *cuneatum*; 4171, *russatum* & *rupicola* v. *rupicola* x *russatum*; 4256, *telmateium*; 4258, *rupicola* v. *rupicola*; 4261, *russatum* x *rupicola* v. *rupicola*; 4328, *rupicola* v. *rupicola*; 4955, *fastigiatum*; 5123, *hippophaeoides* v. *hippophaeoides*; 5124, 5126, *orthocladum* v. *orthocladum*; 5201, 5220, *telmateium*; 5391, *russatum* x *rupicola* v. *rupicola*; 5392, *cuneatum*; 5488, *rupicola* v. *mulienae*; 5490, *telmateium*; 5514, *cuneatum*; 5534, *telmateium*; 5536, *impeditum*; 5543, *rupicola* v. *mulienae*; 5544, *intricatum*; 5593, 5597, *telmateium*; 6334, *fastigiatum*; 6414, *rupicola* v. *chryseum*; 6460, 6473, *thymifolium*; 6534, *fastigiatum*; 6830, *hippophaeoides* v. *hippophaeoides*; 7995, *telmateium*; 8191, *cuneatum*; 8208, *hippophaeoides* v. *hippophaeoides*; 8261, *fastigiatum*; 8278, *yungningense* & *fastigiatum*; 8285, *fastigiatum*; 8317, 8319, 8331, *cuneatum*; 8356, *fastigiatum*; 8362, 8441, *cuneatum*; 8456, *complexum*; 8457, *russatum*; 8494, 8495, *hippophaeoides* v. *hippophaeoides*; 8501, *impeditum*; 8507, *telmateium*; 8509, *cuneatum*; 8527, *hippophaeoides* v. *hippophaeoides*; 8602, *russatum*; 8847, *nivale* ssp. *boreale*; 8849, *tapetiforme*; 8936, *russatum*; 8944, *polycladum*; 8949, 8954, 8955, *rupicola* v. *rupicola*; 8974, *orthocladum* v. *orthocladum* x *hippophaeoides* v. *hippophaeoides*; 9034, *telmateium*; 9094, *rupicola* v. *rupicola*; 9173, 9192, 9194, *russatum*; 9248, *tapetiforme*; 9249, *rupicola* v. *chryseum*; 9266, *nivale* ssp. *boreale* x *tapetiforme*; 9268, 9311, 9312, *nivale* ssp. *boreale*; 9319, *rupicola* v. *chryseum*; 9321, *nivale* ssp. *boreale*; 9362, *rupicola* v. *rupicola*; 9365, *rupicola* v. *chryseum*; 9370, *rupicola* v. *rupicola*; 9492, *nivale* ssp. *australe*; 9493, *fastigiatum*; 9494, *nivale* ssp. *australe*; 9495, 9496, *fastigiatum*; 9510, 9519, *nivale* ssp. *australe*, 9523; *russatum* x *rupicola* v. *rupicola*; 9527, *rupicola* v. *rupicola*; 9554, *russatum* x *rupicola* v. *rupicola*; 9560, *russatum* & *rupicola* v. *rupicola* x *russatum*; 9561, *russatum* x *rupicola* v. *rupicola*; 9563, *polycladum*; 9579, *russatum* x *rupicola* v. *rupicola*; 9584, *nivale* ssp. *australe*; 9663, 9722, 9726, 9731, 9740, 9751, *rupicola* v. *rupicola*; 9754, *hippophaeoides* v. *hippophaeoides*; 9952, *tapetiforme*; 9957, *nivale* ssp. *boreale*; 9958, 10081, 10126, *rupicola* v. *chryseum*; 10552, *cuneatum* x *hippophaeoides* v. *hippophaeoides*; 10553, *telmateium*; 10914, *rupicola* v. *chryseum*; 11086, 11088, 11091, 11092, 11093, 11098, 11109, *tapetiforme*; 11126, *rupicola* v. *chryseum*; 11130, *tapetiforme*; 11148, 11198, *rupicola* v. *chryseum*; 11243, *rupicola* v. *rupicola*; 11249, *nivale* ssp. *australe*; 11271, *cuneatum*; 11284, *russatum* x *rupicola* v. *rupicola*; 11287, *cuneatum*; 11294, 11295, 11296, *russatum*; 11303, *fastigiatum*; 11304, *nivale* ssp. *australe*; 11315, *hippophaeoides* v. *occidentale*; 11318, *russatum*; 11319, *polycladum*; 11363, 11364, 11365, *hippophaeoides* v. *hippophaeoides*; 11368, 11392, 11393, *cuneatum*; 11434, *rupicola* v. *rupicola*; 11465, *telmateium*; 11469, *impeditum*; 12191, *capitatum*; 12368, 12370, *thymifolium*; 12371, 12376, *capitatum*; 12411, *thymifolium*; 12471, 12518, 12647, 12731, *capitatum*; 13303, *thymifolium*; 13596, *capitatum*; 13598, *capitatum* & *thymifolium*; 13600, 13605, 13611, 13622, 13634, 13635, 13674, 13688, *capitatum*; 13904, *thymifolium*; 13905, 13956, 13968, 14006, 14041, 14045, 14101, *capitatum*; 16004, 16006, *telmateium*; 16017, *intricatum*; 16044, *impeditum*; 16081, *telmateium*; 16115, *impeditum*; 16148, *telmateium*; 16178, *rupicola* v. *mulienae*; 16207, *telmateium* & *nivale* ssp. *boreale*; 16218, *impeditum*; 16221, *intricatum*; 16228, 16467, *telmateium*; 16477, *rupicola* v. *mulienae* x *nivale* ssp. *boreale*; 16479, 16480, *rupicola* v. *mulienae*; 16536, *nivale* ssp. *boreale* x *impeditum*; 16638, *impeditum*; 16963, *cuneatum*; 17001, *rupicola* v. *rupicola*;

- 17025, *cuneatum*; 17035, *rupicola* v. *rupicola*; 17108, *cuneatum*; 17113, *rupicola* v. *rupicola*; 17134, *yungningense*; 17135, *orthocladum* v. *longistylum*; 17171, 17179, *rusatum*; 17191, 17194, 17197, *cuneatum*; 17203, *hippophaeoides* v. *hippophaeoides*; 17214, *orthocladum* v. *orthocladum*; 17281, *complexum*; 17283, 17359, *hippophaeoides* v. *hippophaeoides*; 17442, *impeditum*; 17459, *rupicola* v. *mulienae*; 17470, *websteranum* v. *yuloungense*; 17477, 17478, *intricatum*; 17482, *rupicola* v. *mulienae*; 17489, *thymifolium* x *telmateium*; 17490, *websteranum* v. *websteranum*; 17491, *rupicola* v. *mulienae*; 17492, *websteranum* v. *yuloungense*; 17518, *minyaense*; 17519, *thymifolium*; 17534, *minyaense*; 17535, *nivale* ssp. *boreale*; 17557, *intricatum*; 17562, *nivale* ssp. *boreale*; 17577, 17663, *intricatum*; 17703, *thymifolium*; 17722, 17726, 17731, *minyaense*; 17751, *intricatum*; 17840, *telmateium*; 17880, *nivale* ssp. *boreale*; 17897, 17950, *rupicola* v. *mulienae*; 17958, *impeditum*; 17961, *intricatum*; 17967, *rupicola* v. *mulienae*; 17995, *telmateium*; 18143, *impeditum*; 18144, *intricatum*; 18163, *impeditum*; 18187, *impeditum* x *rupicola* v. *mulienae*; 18222, *intricatum*; 18223, *impeditum*; 18244, *rupicola* v. *mulienae*; 18365, 18367, 18442, *rupicola* v. *rupicola*; 18458, *hippophaeoides* v. *occidentale*; 18460, *orthocladum* v. *longistylum*; 18462, *rusatum*; 18512, 18542, *rupicola* v. *rupicola*; 22063, *rupicola* v. *chryseum*; 22288, *tapetiforme*; 22498, *rupicola* v. *chryseum*; 22632, *rupicola* v. *rupicola*; 22800, *tapetiforme*; 22803, *nivale* ssp. *boreale*; 22806, *rupicola* v. *chryseum*; 22809, *nivale* ssp. *boreale* x *indet.* parent; 22810, 22829, *tapetiforme*; 22848, *nivale* ssp. *boreale*; 22872, *tapetiforme*; 22902, 22943, *rupicola* v. *chryseum*; 23079, *rupicola* v. *rupicola*; 23153, 23210, *rupicola* v. *chryseum*; 23310, 23316, 23317, *nivale* ssp. *boreale*; 23360, 23398, *rupicola* v. *chryseum*; 23467, *rupicola* v. *rupicola*; 23540, *rupicola* v. *chryseum*; 23712, *telmateium*; 23720, *impeditum*; 23734, *thymifolium*; 23772, *telmateium*; 23784, *impeditum*; 23790, *telmateium*; 23839, *nivale* ssp. *boreale*; 23853, 23854, *rupicola* v. *mulienae*; 23925, *intricatum*; 23926, *impeditum*; 23967, *rupicola* v. *mulienae*; 23971, *intricatum*; 24278, *impeditum*; 24319, *telmateium*; 24320, *thymifolium*; 24336, 24361, *telmateium*; 24369, 24384, *impeditum*; 24385, 24395, *nivale* ssp. *boreale*; 24446, *intricatum*; 24460, 24464, *impeditum*; 24645, *nivale* ssp. *australe*; 24659, *complexum*; 24694, *rusatum*; x *indet.* parent; 24701, 24729, *hippophaeoides* v. *hippophaeoides*; 24740, *telmateium*; 24805, *rupicola* v. *rupicola*; 24858, *telmateium*; 24973, *fastigiatum*; 24975, *telmateium*; 24976, *fastigiatum*; 25036, *rupicola* v. *rupicola* x *fastigiatum*; 25046, *hippophaeoides* v. *hippophaeoides*; 25081, *nivale* ssp. *australe*; 25150, *cuneatum*; 25258, 25277, 25302, *rupicola* v. *rupicola*; 25370, *yungningense*; 25377, *nivale* ssp. *australe*; 25402, *hippophaeoides* v. *hippophaeoides*; 25417, *fastigiatum*.
- Schneider: 906, *amundsenianum*; 953, *tsaii* x *hippophaeoides* v. *hippophaeoides*; 1303, *cuneatum*; 2179, *rupicola* v. *rupicola*; 3481, 3538, *hippophaeoides* v. *hippophaeoides*; 4084, *rupicola* v. *chryseum*.
- Shritha: 5401, *nivale* ssp. *nivale*.
- Smith: 2601, 3701, 4390, *capitatum*; 11063, *intricatum*; 11730, *flavidum* v. *flavidum*; 12375, *intricatum*; 12882, *nitidulum* v. *nitidulum*; 12883, *intricatum*; 12945, *thymifolium*; 12951, *nivale* ssp. *boreale*; 13008, *thymifolium*; 13922, *intricatum*.
- Soulié: 187, 330, *intricatum*; 331, *flavidum* v. *flavidum*; 398, *intricatum*; 486, *thymifolium*; 614, *intricatum*; 625, *flavidum* v. *flavidum*; 765, *intricatum*; 886, *thymifolium* & *websteranum* v. *websteranum*; 965, *intricatum*; 1005, *rupicola* v. *chryseum*; 2772, 3303, 3304, 3708, 3709, 3710, *nivale* ssp. *boreale*; s.n. (1893), *thymifolium*.
- Stainton: 4387, 4728, *nivale* ssp. *nivale*.
- Stevens: 152, 237, *flavidum* v. *flavidum*; 239, *nivale* ssp. *boreale* & *websteranum* v. *websteranum*; 347, 350, *flavidum* v. *flavidum*; 351, *thymifolium*; 352, *minyaense*.
- Tsai: 50928, *tsaii*; 58152, *rupicola* v. *rupicola*.
- Wager: 205, *nivale* ssp. *nivale*.
- Walsh: 135, *nivale* ssp. *nivale*.
- Wang: 21175, *nivale* ssp. *boreale*; 23448, *nitidulum* v. *omeiense*; 63246, 63259, *impeditum*; 63825, *rupicola* v. *rupicola*; 64826, *rupicola* v. *chryseum*; 64653, 64847, 64909, 64966, 64983, *rupicola* v. *rupicola*; 65551, *rupicola* v. *chryseum*; 66031, 66131, *rupicola* v. *rupicola*; 66459, *rupicola* v. *chryseum*; 66464, *nivale* ssp. *boreale* x *tapetiforme*; 66472, *nivale* ssp. *boreale*; 67089, 67094, 67347, 69502, *rupicola* v. *rupicola*; 70807, 71025, *telmateium*; 71172, *impeditum*.
- Ward: 269A, *telmateium*; 269B, *hippophaeoides* v. *hippophaeoides*; 540, *rupicola* v. *chryseum*; 541, *nivale* ssp. *boreale*; 795, *tapetiforme*; 1794, 3304, *rupicola* v. *rupicola*; 4023, *rupicola* v. *mulienae*; 4102, *telmateium*; 4184, *intricatum*; 4186, *impeditum*; 4268, *telmateium*; 4341, *cuneatum*; 4413, *impeditum*; 4429, *rupicola* v. *mulienae*; 4444, *impeditum*; 4456, *impeditum* x *indet.* parent; 4456, (raised at Kew) *flavidum* x *indet.* parent; 4486, *cuneatum*;

- 4679, *nivale* ssp. *boreale*; 4733, *telmateium*; 5030, *cuneatum* & *cuneatum* x *indet.* parent; 5035, *hippophaeoides* v. *hippophaeoides*; 5037, 5049, *cuneatum*; 5065, *orthocladum* v. *orthocladum* & *telmateium*; 5092, *intricatum*; 5103, *cuneatum*; 5128, 5128A, *intricatum*; 5129, *cuneatum* x *indet.* parent; 5130, *impeditum*; 5135, *intricatum*; 5140, *thymifolium*; 5147, *impeditum*; 5148, *impeditum* & *impeditum* x *nivale* ssp. *boreale*; 5151, *telmateium*; 5152, *rupicola* v. *mulienae*; 5158, *telmateium* x *intricatum*; 5161, *thymifolium*; 5179, *telmateium*; 5184, *impeditum*; 5188, *telmateium*; 5196, *nivale* ssp. *boreale*; 5198, *telmateium*; 5199, *nivale* ssp. *boreale* x *impeditum*; 5218, *telmateium*; 5287, *hippophaeoides* v. *hippophaeoides*; 5298, 5299, *rupicola* v. *rupicola*; 5327, *rupicola* v. *chryseum*; 5337, *rupicola* v. *chryseum* & *tapetiforme*; 5385, *tapetiforme*; 5644, *bulu*; 5667, *nivale* ssp. *nivale*; 5686, 5714, *bulu*; 5729, *nivale* ssp. *nivale*; 5735, *nivale* ssp. *nivale* x *bulu*; 5777, 5778, 5779, 5780, 5792, 5862, 5922, 5950, *nivale* ssp. *nivale*; 6960, *tapetiforme*; 7001, *nivale* ssp. *nivale*; 7048, *rupicola* v. *rupicola*; 10595, *nivale* ssp. *nivale*; 7633, *tapetiforme*; 9609, *rupicola* v. *chryseum*; 9710, *rupicola* v. *rupicola*; 10005, *tapetiforme* x *rupicola* v. *rupicola*; 10521, *tapetiforme* & *nivale* ssp. *nivale*; 10531, *rupicola* ssp. *rupicola* x *nivale* subsp. *nivale*; 10533, *rupicola* v. *rupicola*; 10595, *nivale* ssp. *nivale*; 10716, *nivale* ssp. *nivale* & *tapetiforme*; 11016, 11610, 11676, 11804, 12120, *nivale* ssp. *nivale*; 13365, *rupicola* v. *rupicola*; 13370, *tapetiforme*; 13701, *nivale* ssp. *nivale*; 15005, *tapetiforme*; 19606, *nivale* ssp. *nivale*.
- Wilson: 1202, *flavidum* v. *flavidum*; 1225, *websterianum* v. *websterianum*; 1319, *nivale* ssp. *boreale*; 1773 (raised at Kew), *flavidum* v. *flavidum*; 3452, *flavidum* v. *psilostylum*; 3458, *nitidulum* v. *nitidulum*; 3460, *nivale* ssp. *boreale*; 3461, *nitidulum* v. *nitidulum*; 3462, *websterianum* v. *websterianum*; 3463, *nivale* ssp. *boreale*; 3464, *flavidum* v. *flavidum* x *indet.* parent; 3465, *nivale* ssp. *boreale*; 3466, *intricatum*; 3467, *nivale* ssp. *boreale* x *indet.* parent; 3467a, 3468, 3469, *nivale* ssp. *boreale*; 3932, *flavidum* v. *flavidum*; 3934, *intricatum*; 3935, *nitidulum* v. *nitidulum*; 3935a, *nitidulum* v. *omeiense*; 3936, *minyaense*; 4269, *nivale* ssp. *boreale*.
- Younghusband: s.n., *nivale* ssp. *nivale*.
- Yü: 5135, *hippophaeoides* v. *hippophaeoides*; 5327, *cuneatum*; 5632, *intricatum*; 5752, *nivale* ssp. *boreale* x *impeditum*; 5981, 6066, *thymifolium*; 6190, *telmateium*; 6205, *rupicola* v. *chryseum*; 6465, *telmateium*; 6795, *nivale* ssp. *australe*; 6825, *rupicola* v. *chryseum*; 7040, *rupicola* v. *mulienae*; 7050, *nivale* ssp. *australe*; 7083, *telmateium*; 7084, 7191, 7244, *impeditum*; 7863, 7887, *rupicola* v. *chryseum*; 7994, *nivale* ssp. *boreale*; 7995, 8624, *rupicola* v. *chryseum*; 10682, 10687, *rupicola* v. *rupicola*; 10689, *cuneatum* x *indet.* parent; 10779, *rupicola* v. *chryseum*; 11195, 11344, *hippophaeoides* v. *hippophaeoides*; 11381, 11385, *complexum*; 11587, 11613, *russatum*; 11637, *complexum*; 11662, *hippophaeoides* v. *hippophaeoides*; 12314, *tapetiforme*; 12948, *nivale* ssp. *australe*; 13356, *complexum*; 13652, *rupicola* v. *rupicola* x *impeditum*; 13736, *rupicola* v. *rupicola*; 13740, *complexum*; 13845, 13937, *hippophaeoides* v. *hippophaeoides*; 13984, *impeditum*, *rupicola* v. *rupicola* & *russatum*; 14444, *impeditum* & *impeditum* x *nivale* subsp. *boreale*; 14548, *rupicola* v. *chryseum*; 14641, *rupicola* v. *mulienae*; 14803, *thymifolium*; 15010, *hippophaeoides* v. *hippophaeoides*; 15027, 15092, *cuneatum*; 15155, *telmateium*; 19065, 19358, *rupicola* v. *chryseum*; 19741, *rupicola* v. *rupicola*; 19792, *rupicola* v. *chryseum*; 20608, *rupicola* v. *rupicola*; 22133, *rupicola* v. *chryseum*.
- Yu-shi-Liu: 1516, *nitidulum* v. *omeiense*.
- Zimmermann: 523, 538, *nivale* ssp. *nivale*.

ADDENDUM

While this revision was in press, a copy of *Iconographia Cormophytorum Sinicorum*, vol. 3, 1974 (Botany Department of Chinese School of Science, Editor), was received. This includes illustrations of, and a key to, many species of Section *Lapponicum*. A translation of the key shows that several Chinese species are not included, and that the treatment is not based on a critical revision of that group.

BOOK REVIEW

Fauna and Flora of St Andrews Bay. This book* contains all the known records of marine plants and animals from the coastal region between the Tay estuary and the Isle of May. The records which cover the period from the great days of marine biology in the latter part of the 19th century up to the early 1960s have, for the most part, been made by workers at the Gatty Marine Laboratory, St Andrews.

The botanical section, edited by Dr M. C. Helen Blackler (mysteriously condensed to "M." by the publishers), lists 362 species of algae plus a few flowering plants, fungi and lichens. She also gives some information on the types of habitat in which the plants are to be found, their reproductive features and, occasionally, their abundance. In nomenclatural matters concerning the macroalgae Dr Blackler claims to follow the Parke & Dixon (1968) check-list but, in fact, she departs from that publication in some instances. For example, *Desmotrichum undulatum* (J. Ag.) Reinke has now been lumped with *Punctaria tenuissima* (C. Ag.) Grev., probably justifiably but unfortunately without explanation. In other instances it would have been more sensible not to use the check-list; e.g. *Gomontia polyrrhiza* (Lagerh.) Born. & Flah. has been a fairly meaningless name for 15 years and this record should now be given as *Eugomontia sacculata* Kornmann. Dr Blackler has retained some of the infraspecific taxa long abandoned in recent check-lists. Wholesale rejection of these taxa was always wrong but their modest (and unexplained) revival here has been conducted in a haphazard manner and with scant regard for the rules.

Some of the reproductive records are puzzling; e.g. unilocular sporangia in *Dictyota* (? tetrasporangia), spermatangia and carposporangia as well as α spores and β spores in the Bangiaceae. The index, which purports to italicise synonyms in fact contains too many typographic errors to be of much use as a guide to synonymy. These are fairly minor points and it would be wrong to labour them excessively because this section contains a great deal of valuable observation.

The zoological section compiled by Professor M. S. Laverack has, by contrast, a much tidier and more professional style of presentation. However, zoologists will be disheartened to see that in more than one third of the records nothing at all has been added to our knowledge of the species at any time in the present century. Information on even such well-known creatures as *Flustra foliacea*, *Nephrops norvegicus*, *Tellina tenuis*, *Solea solea* and *Clupea harengus* remains as when they were first reported by McIntosh 100 years ago, for all the world as if preserved in formalin. The botanical section is certainly free from this fault and one feels confident that Dr Blackler has both seen and known her plants. Nevertheless, the fact of her retirement a few years ago only deepens the impression that this book is a piece of marine biological history rather than the product of sustained academic research.

The quality of book production is not high enough to survive the heavy usage one expects or hopes a systematic text will receive. The inclusion of a map showing substrates, depth contours and place names would surely not have added much to the cost but would have greatly enhanced its usefulness. There is too much evidence of shaky proof reading everywhere and the price is a bit stiff.

GEORGE RUSSELL

* *Fauna and Flora of St Andrews Bay.* Edited by M. S. Laverack and M. Blackler. 310 pp. Scottish Academic Press, Edinburgh. Price £5.00 net.